

FIG. 1





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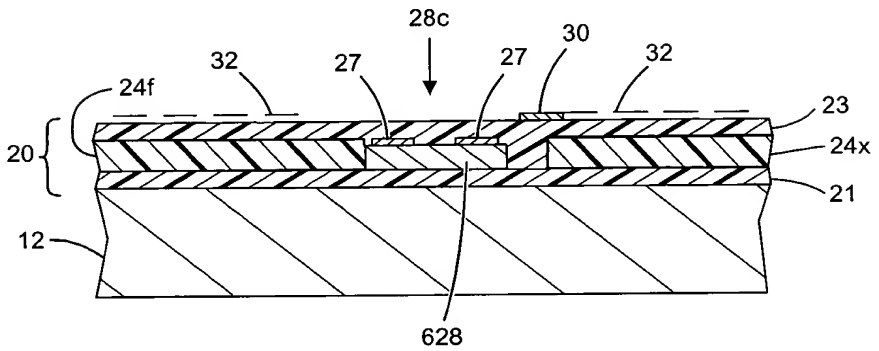


FIG. 4-1

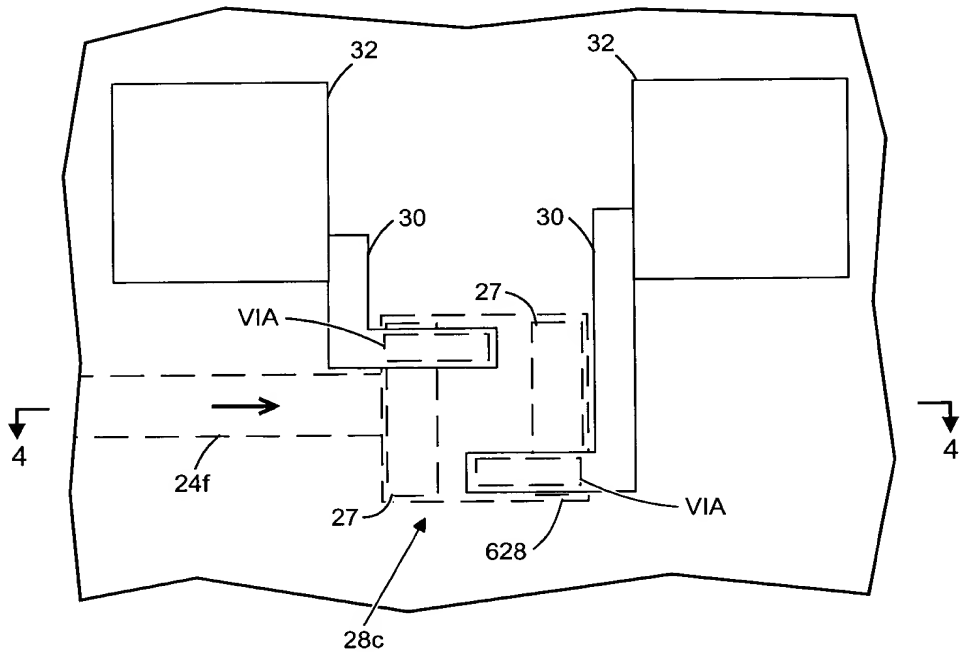
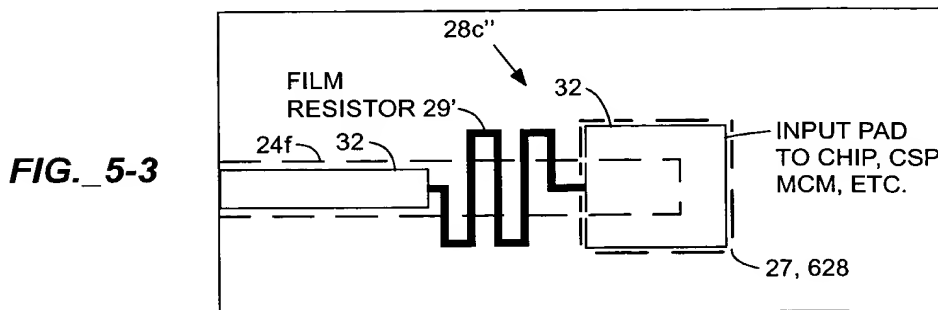
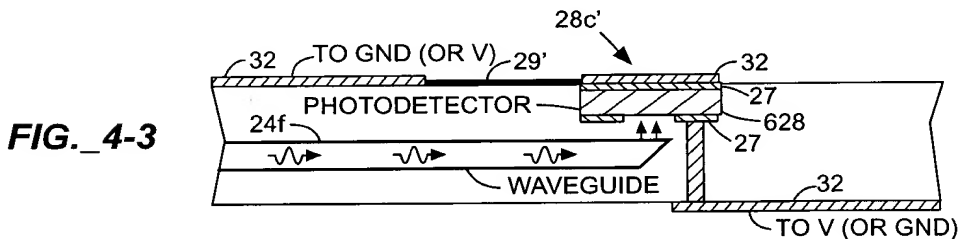
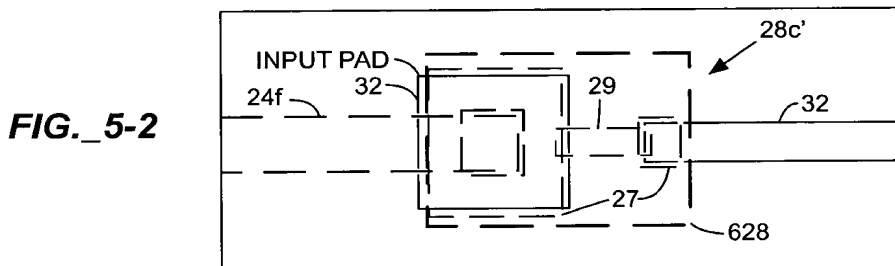
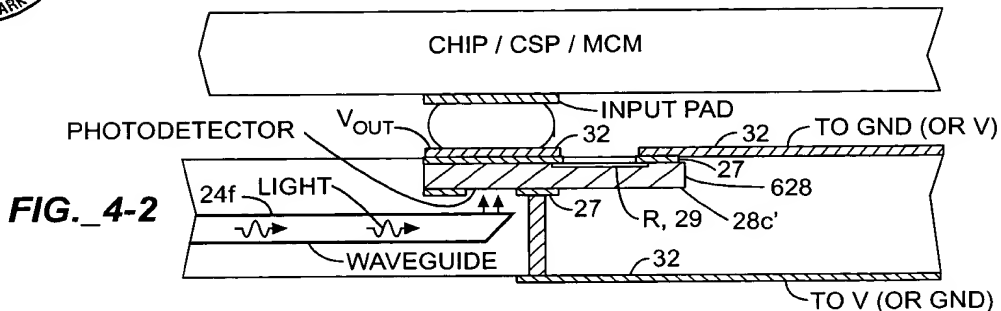


FIG. 5-1



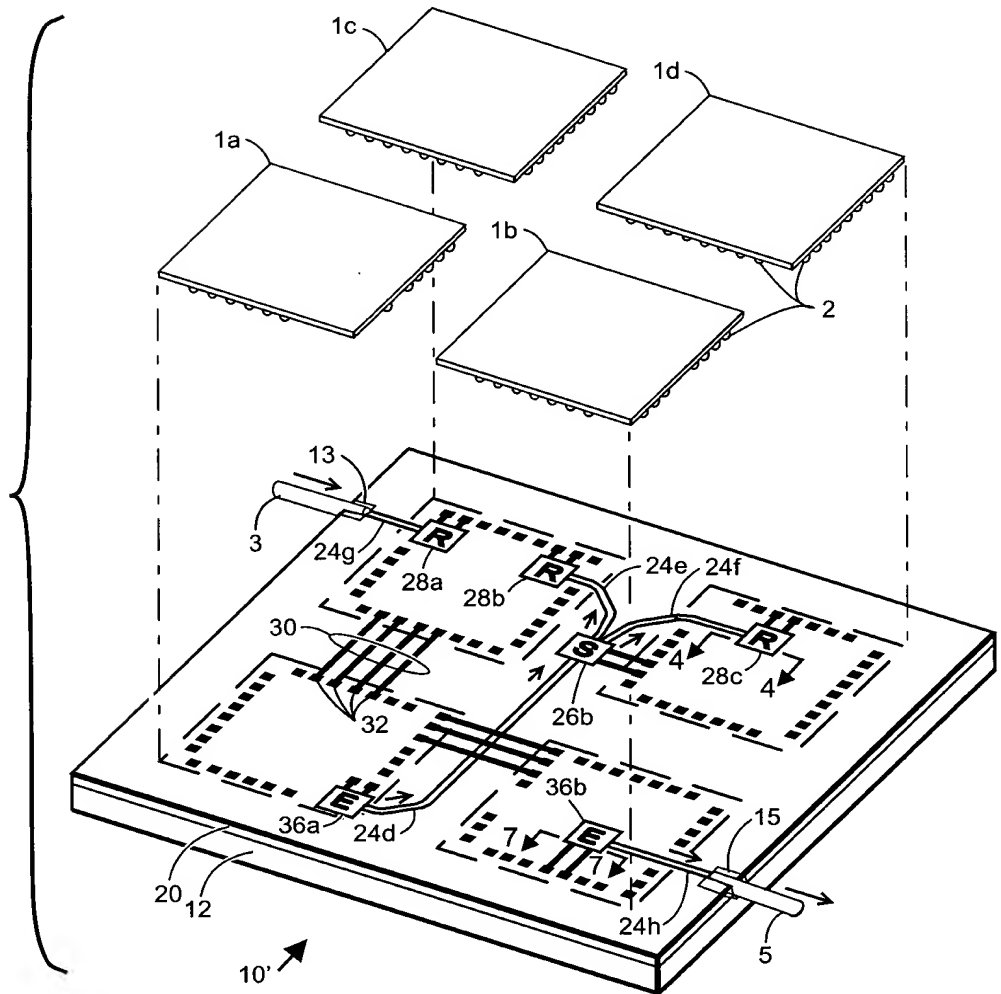


FIG._6

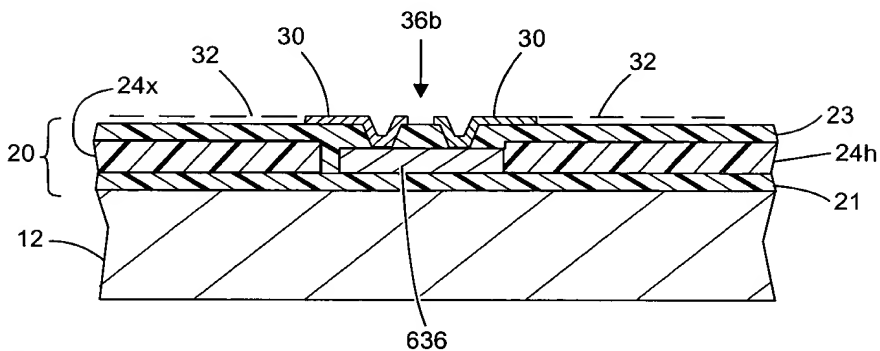


FIG. 7

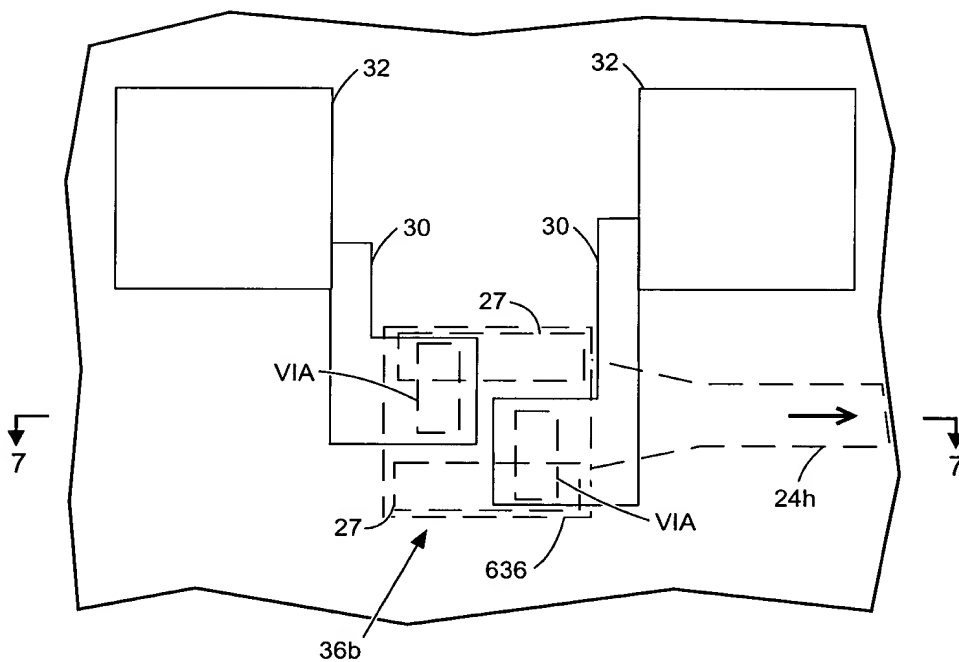


FIG. 8

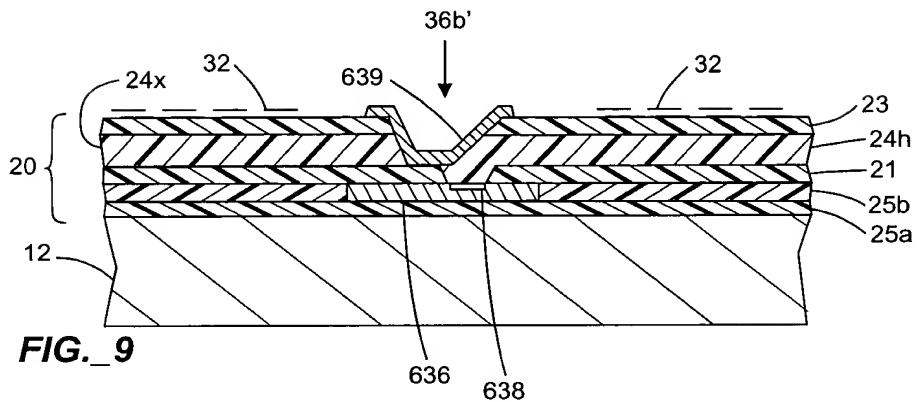


FIG._9

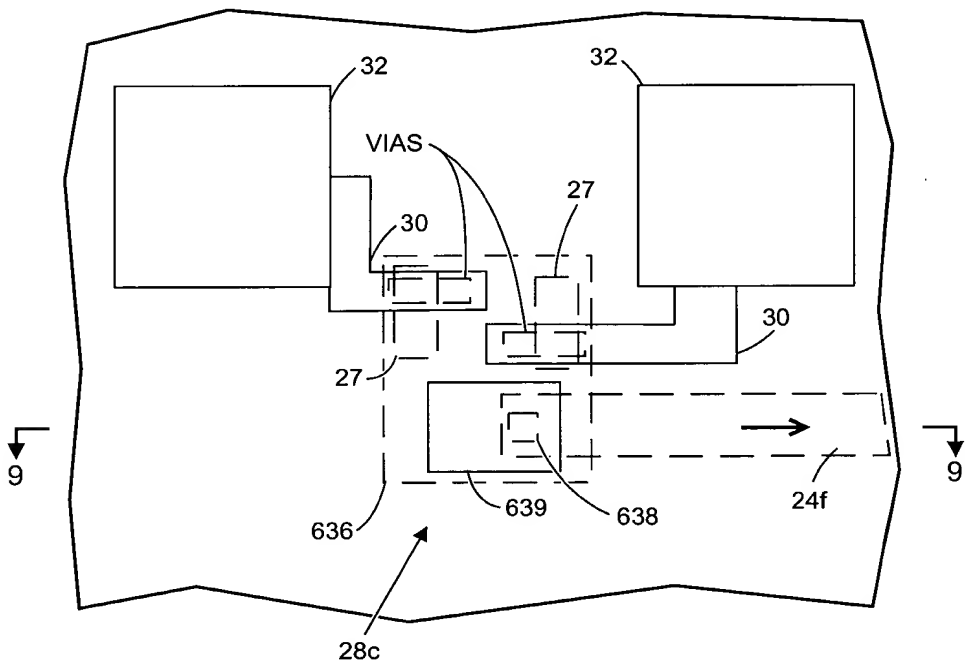


FIG. 10



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FIG._11

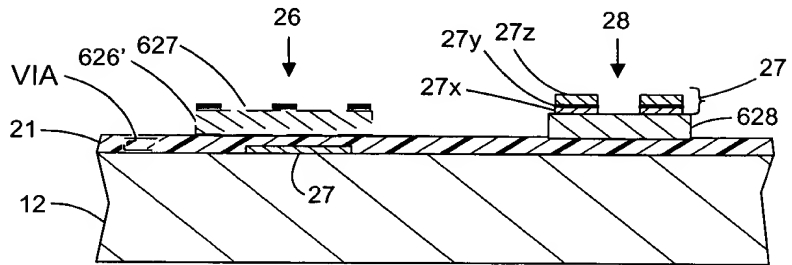


FIG._12

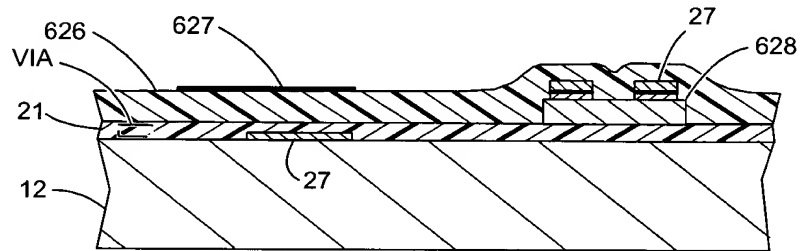


FIG._13

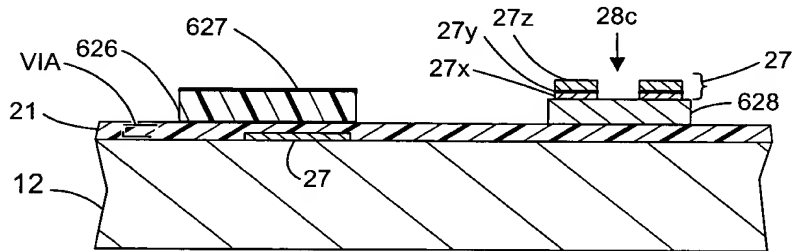
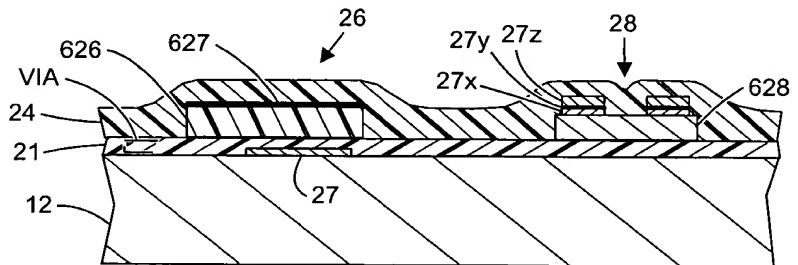
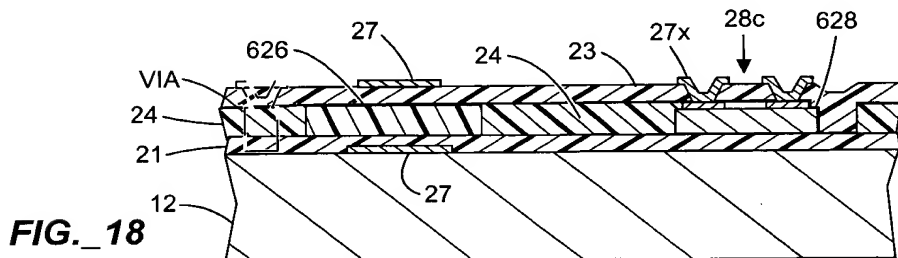
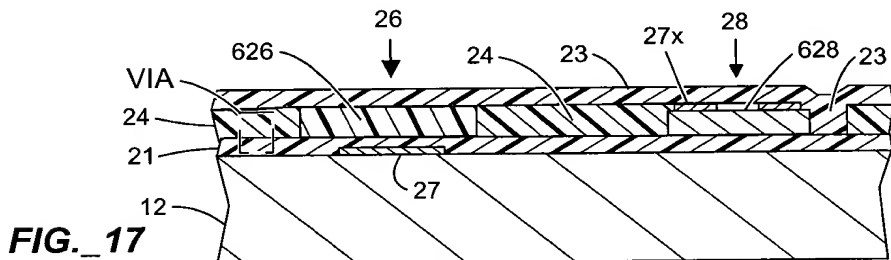
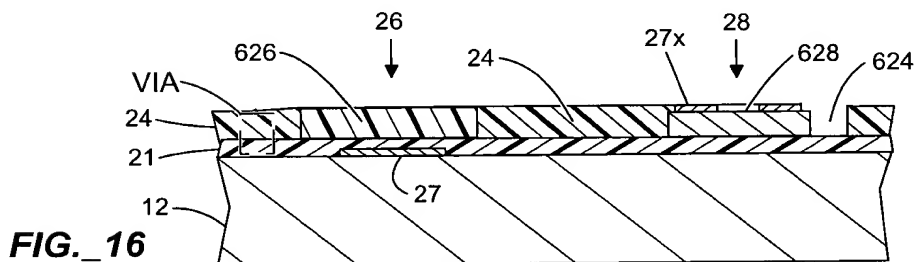
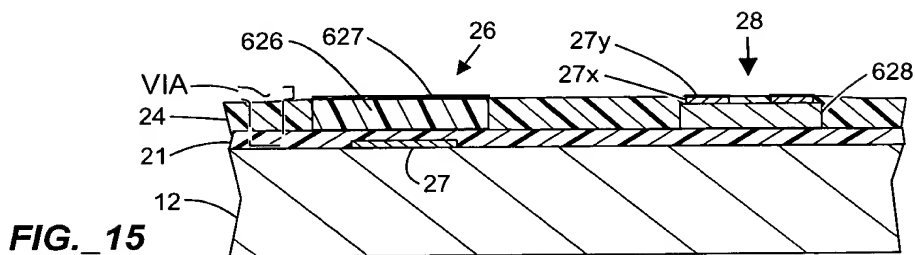


FIG._14







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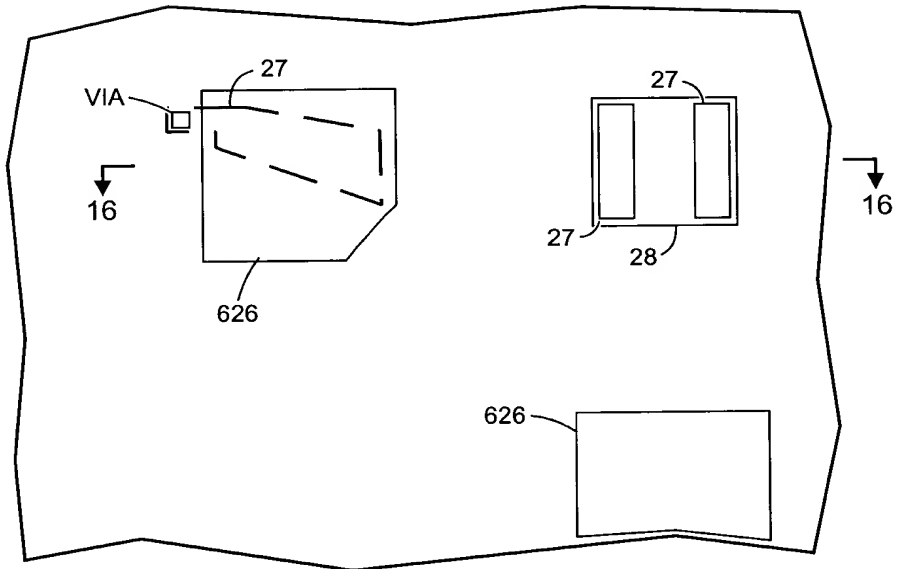


FIG. 19

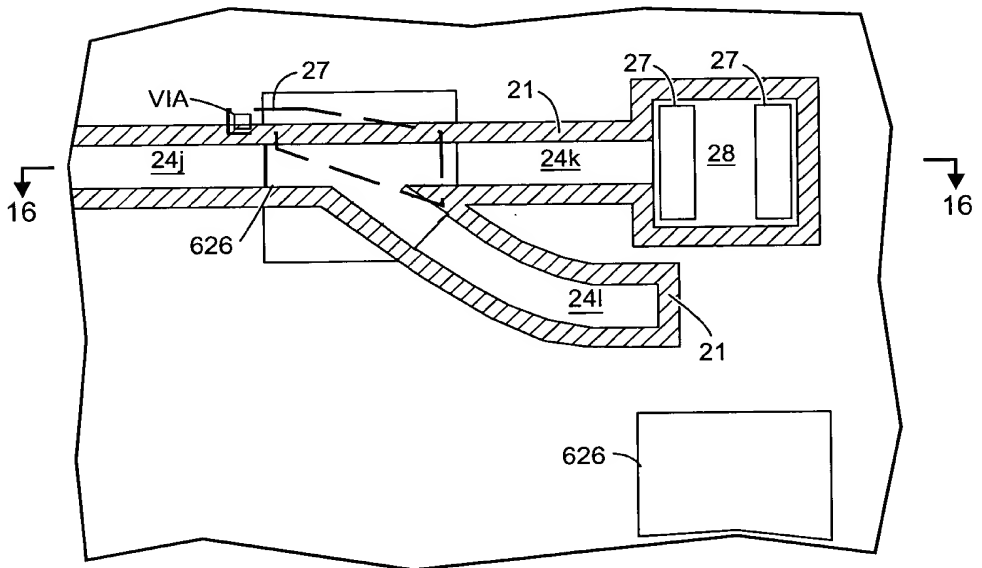


FIG. 20

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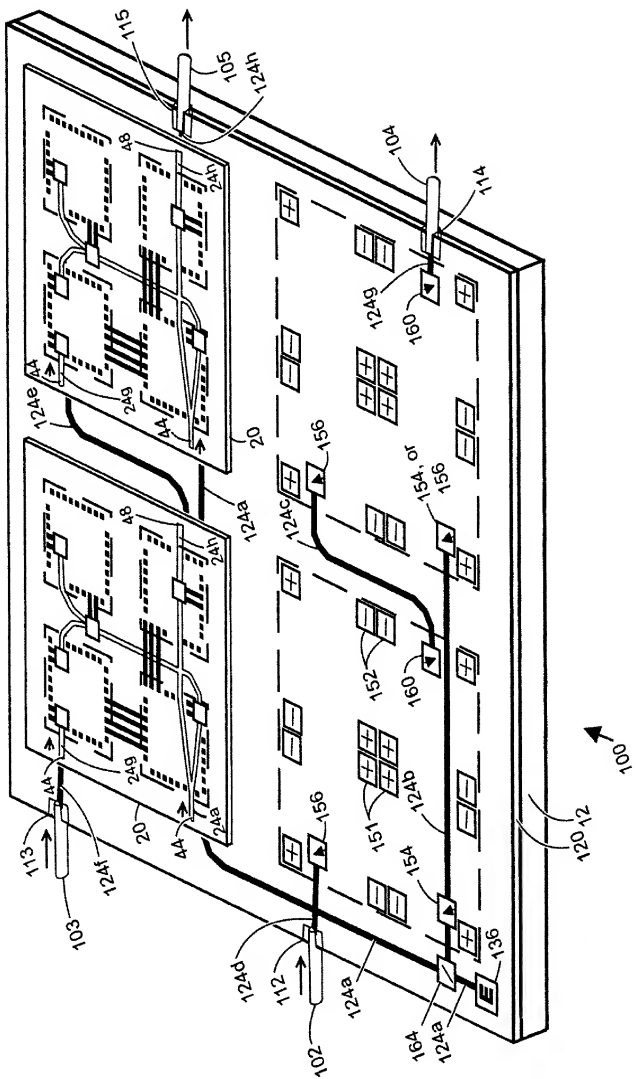


FIG. 21

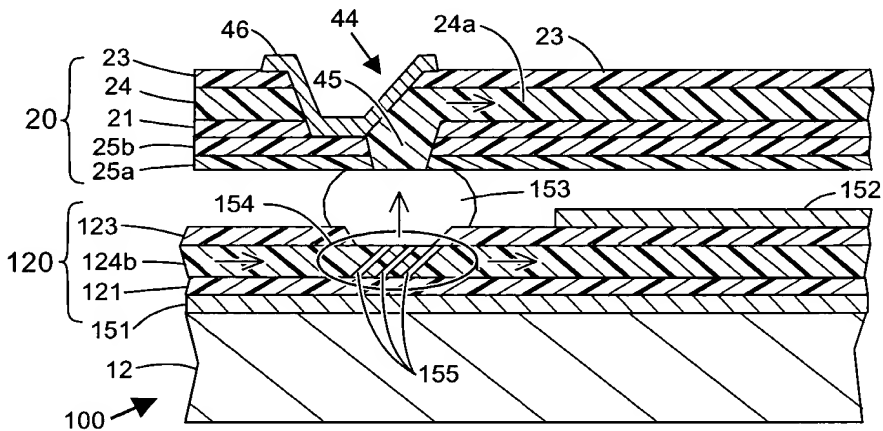


FIG._22

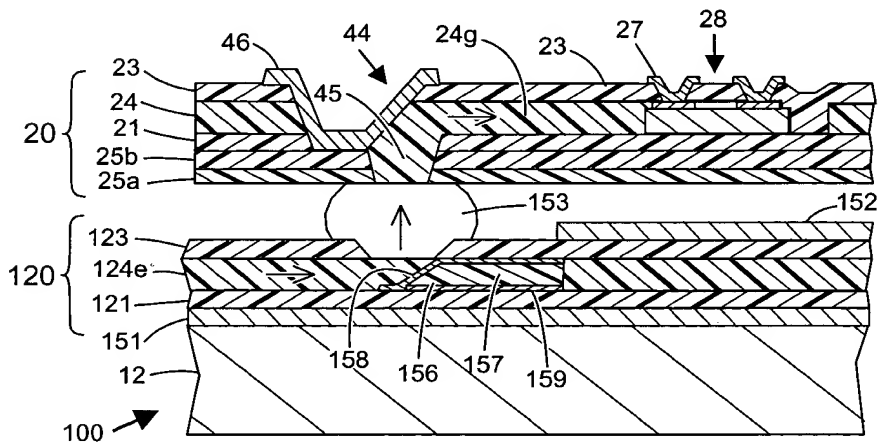


FIG._23

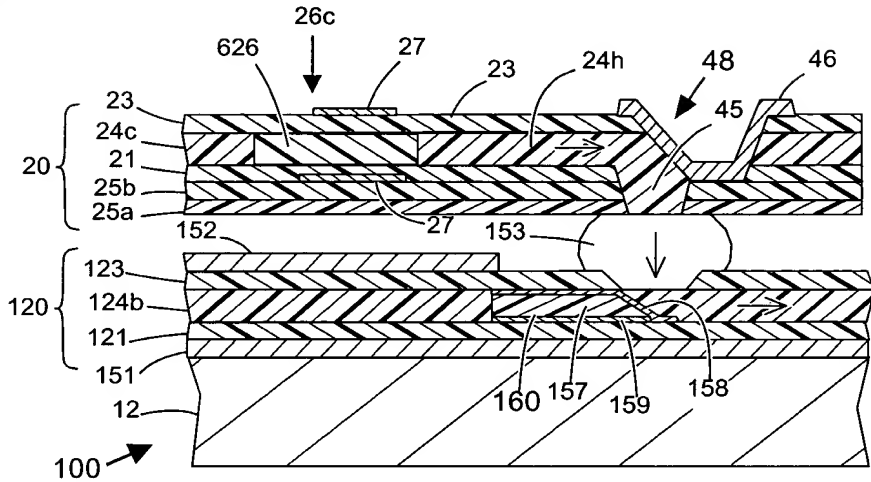


FIG._24

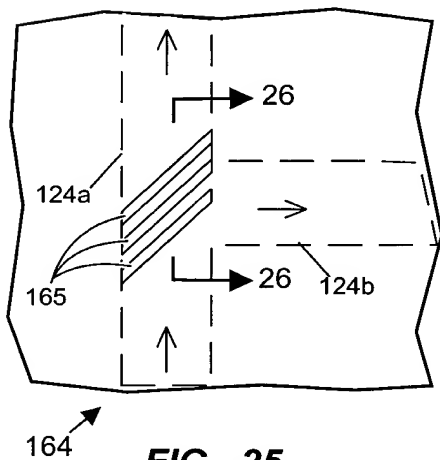


FIG. 25

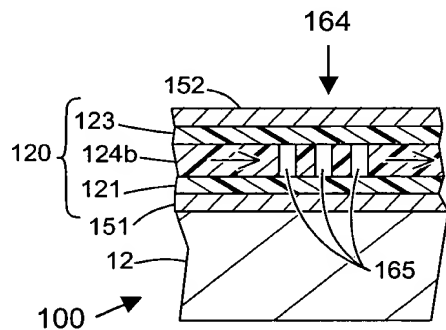
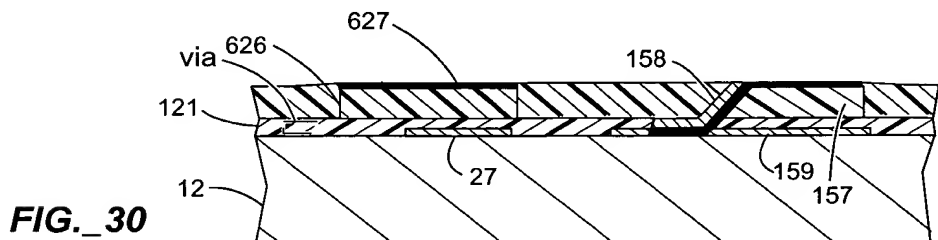
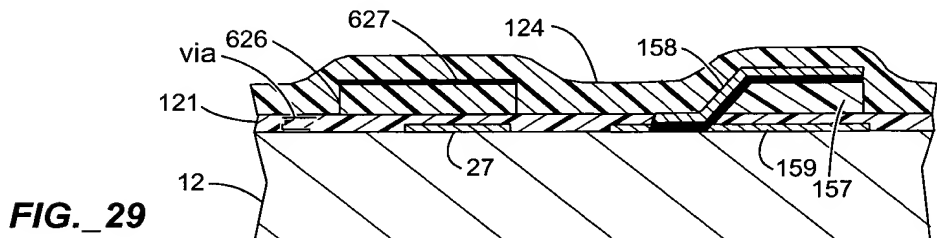
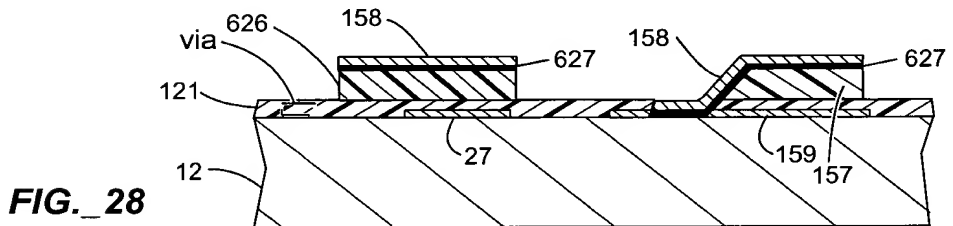
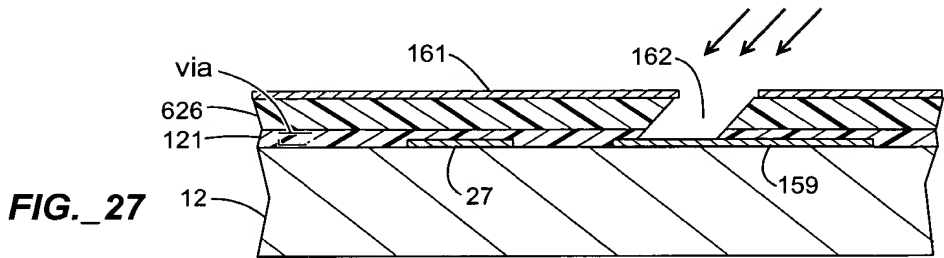


FIG._26



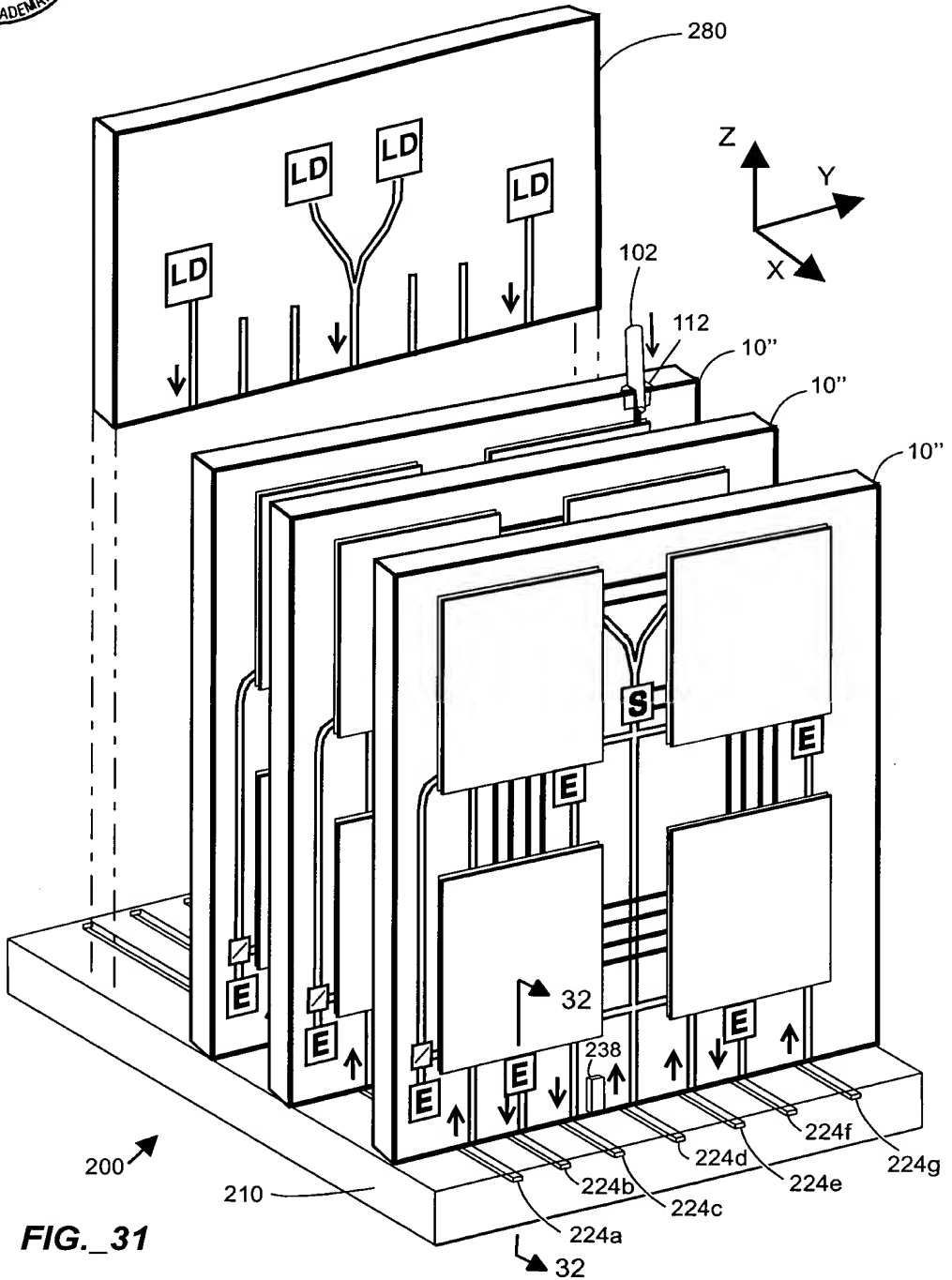


FIG. 31

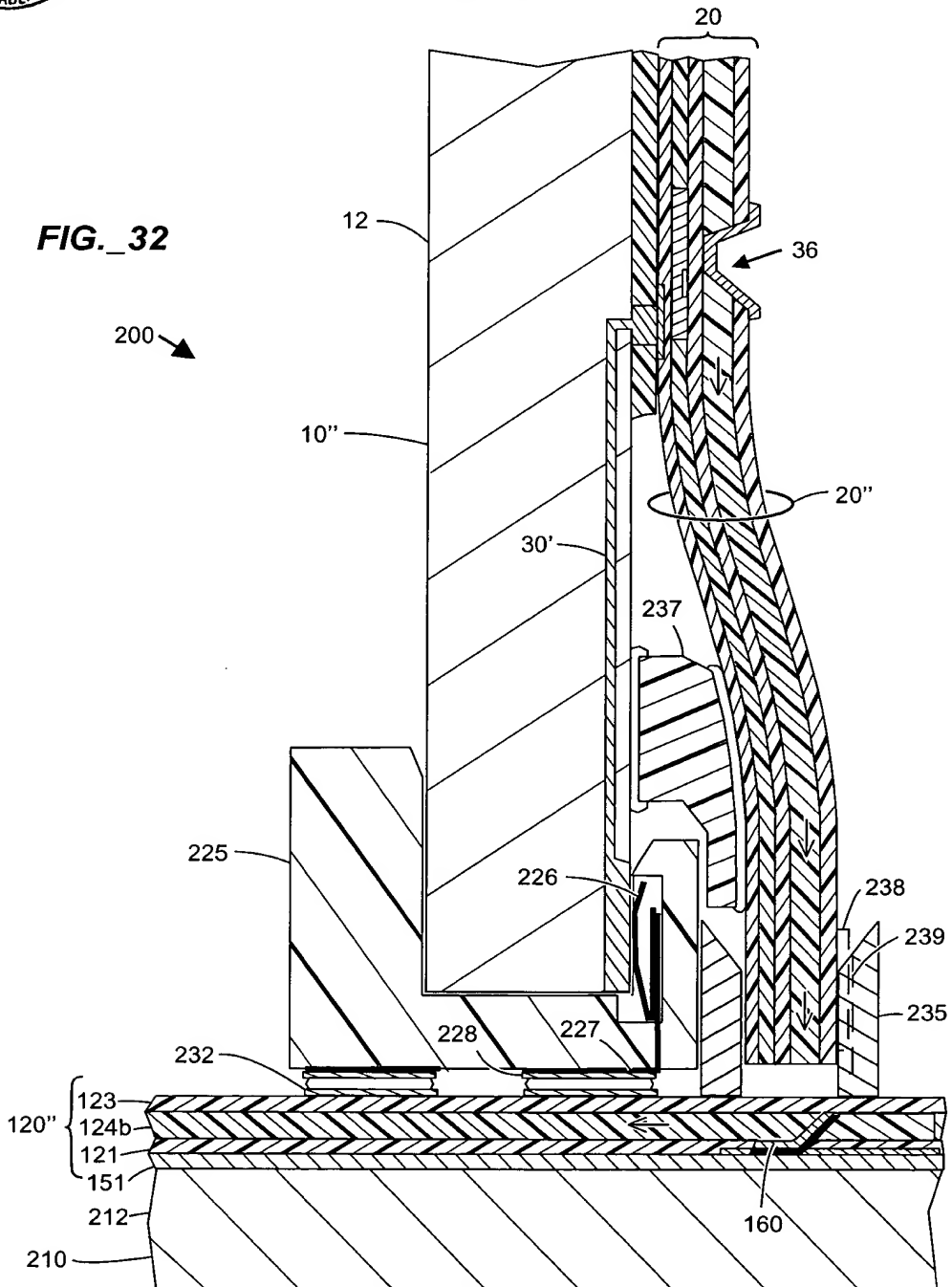
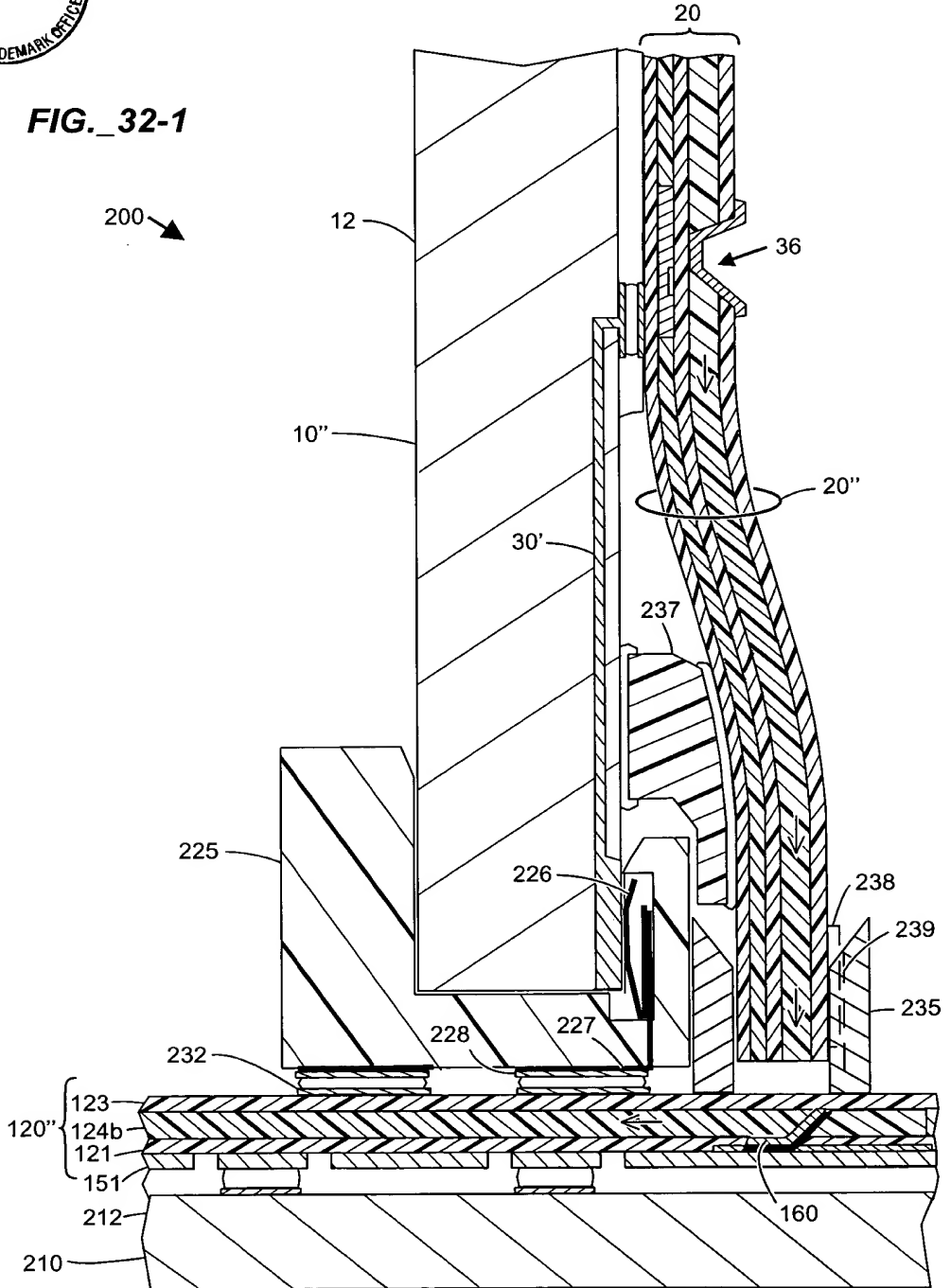
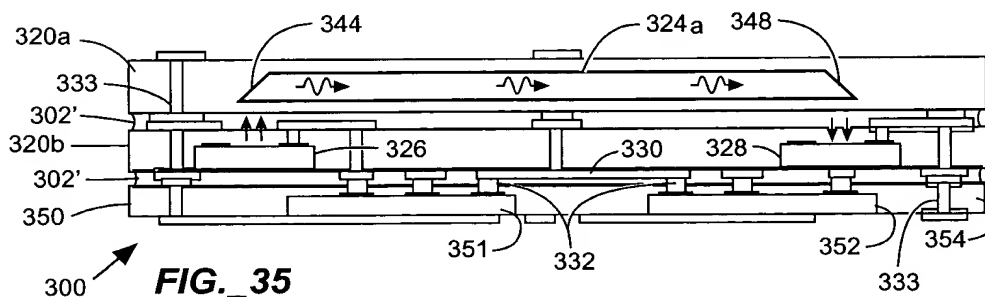
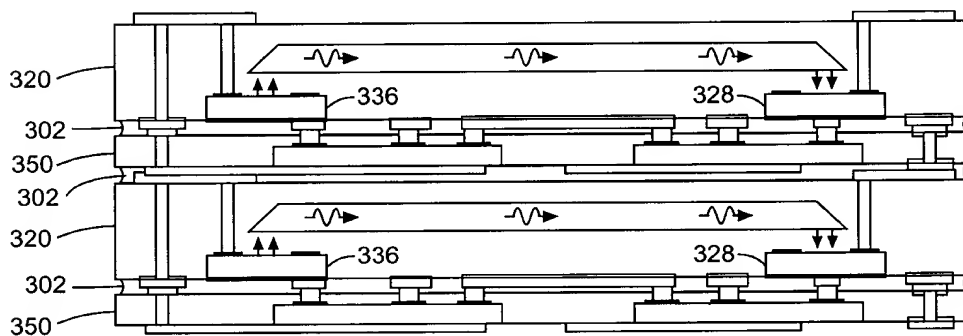
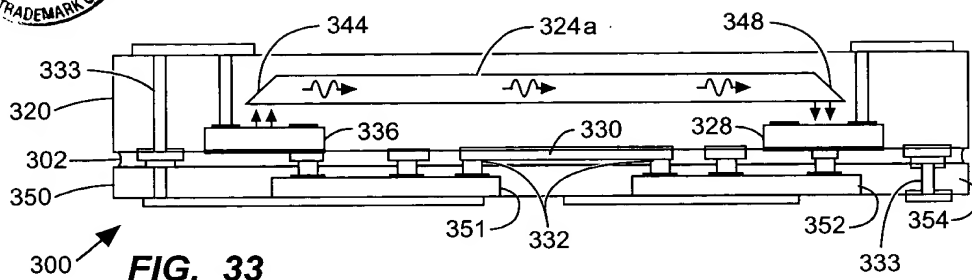




FIG. 32-1





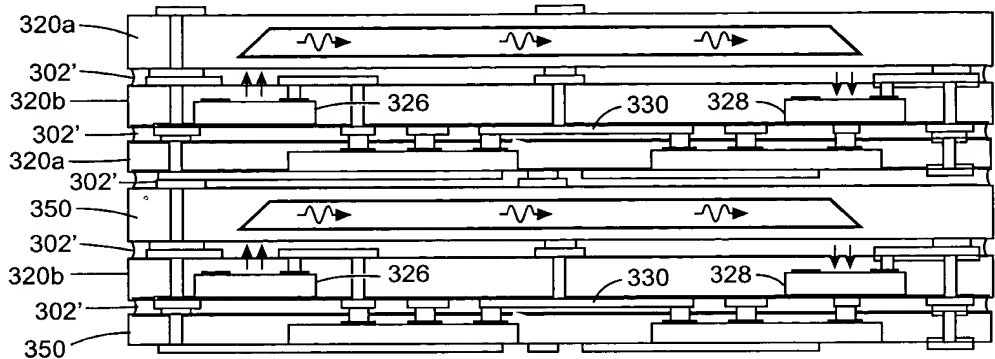


FIG. 36

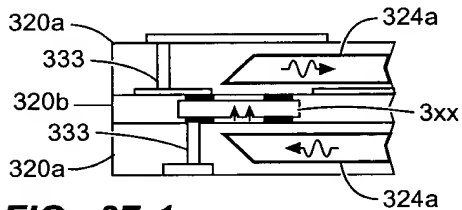


FIG. 37-1

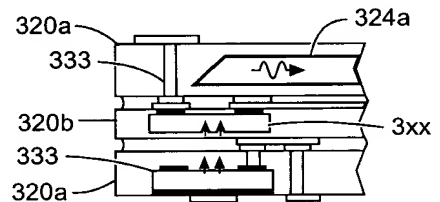


FIG. 37-2

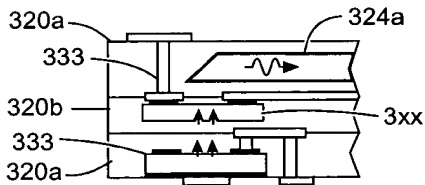


FIG. 37-3

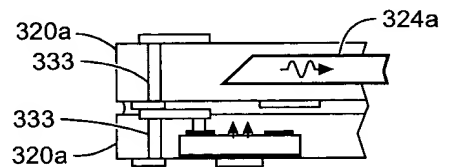
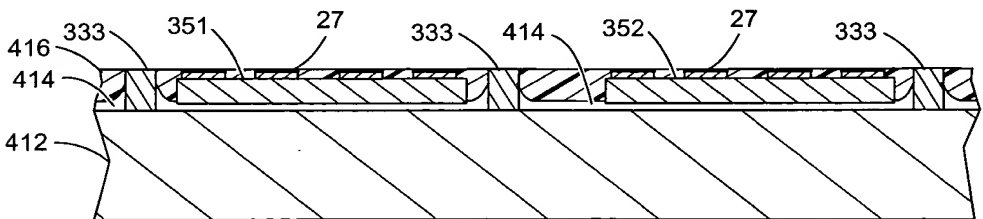
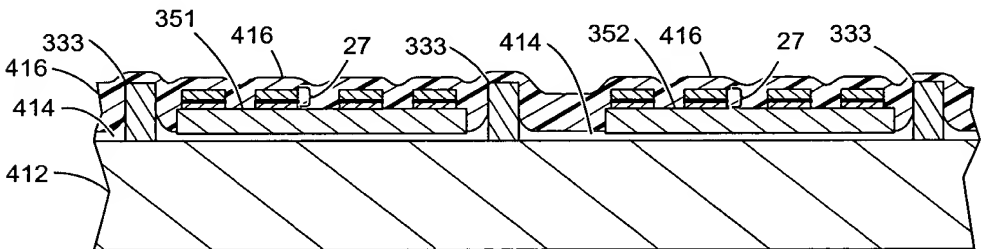
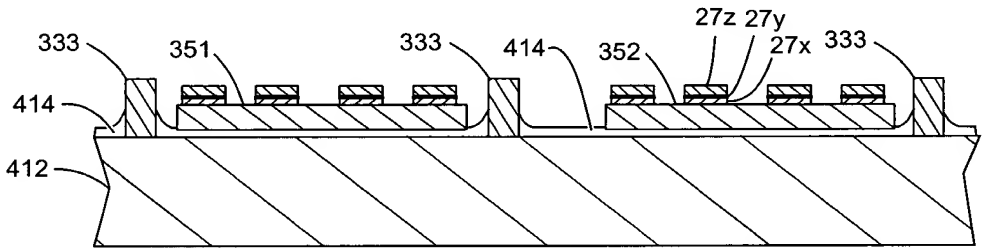
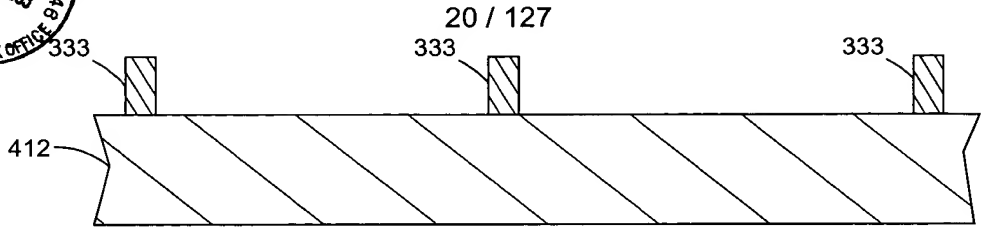
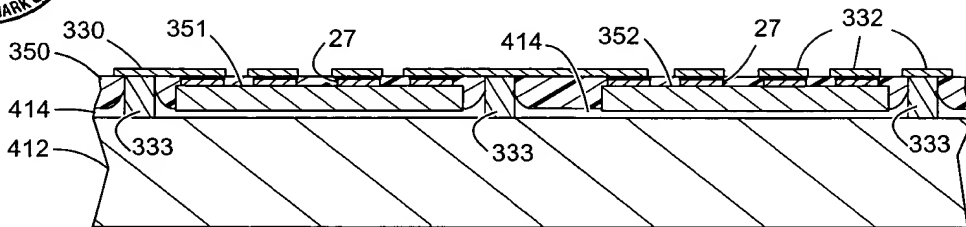
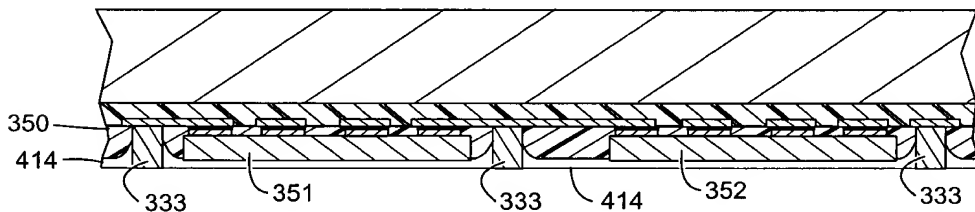
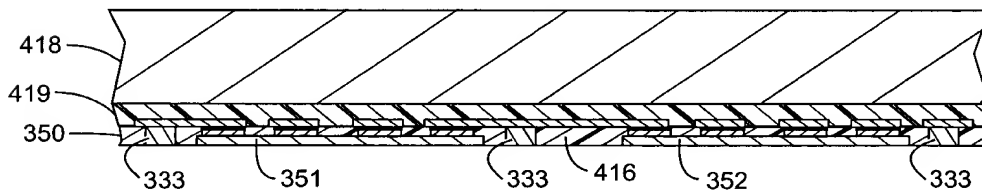
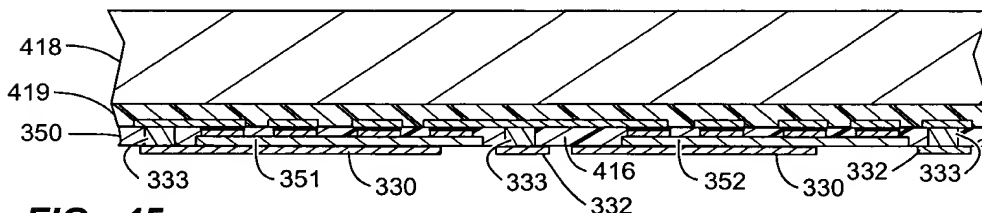
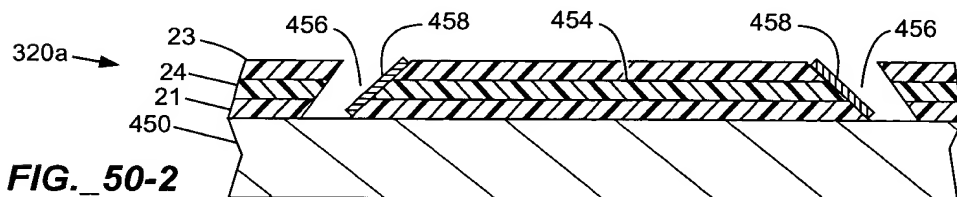
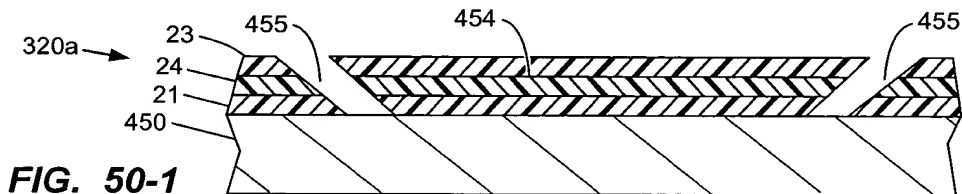
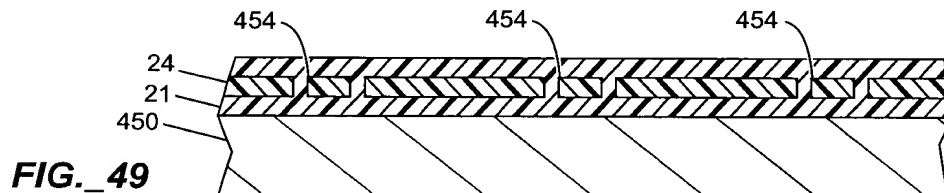
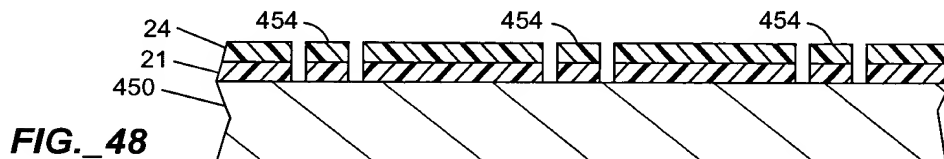
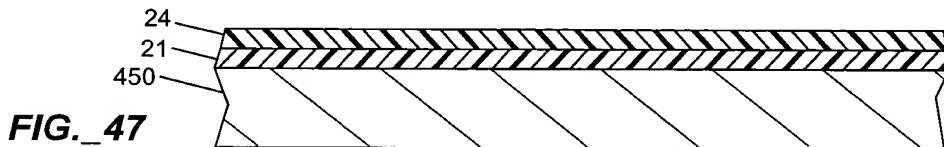
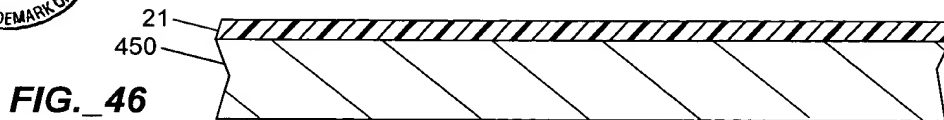


FIG. 37-4



**FIG. 42****FIG. 43****FIG. 44****FIG. 45**



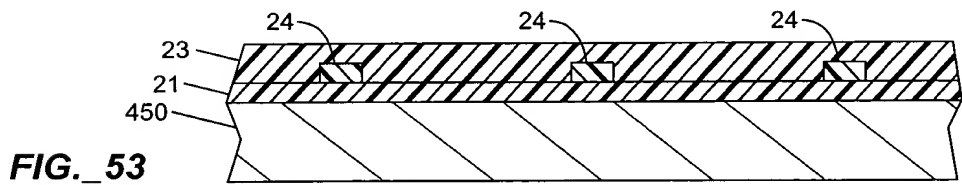
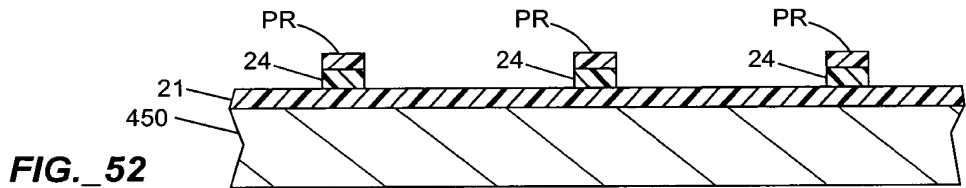
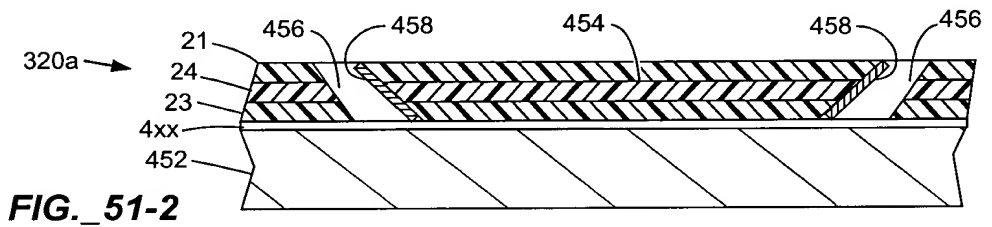
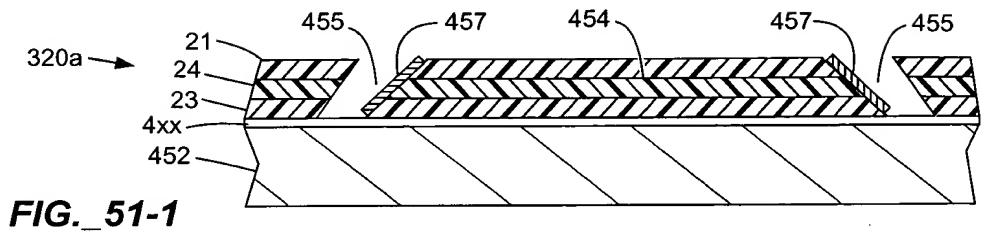




FIG._54

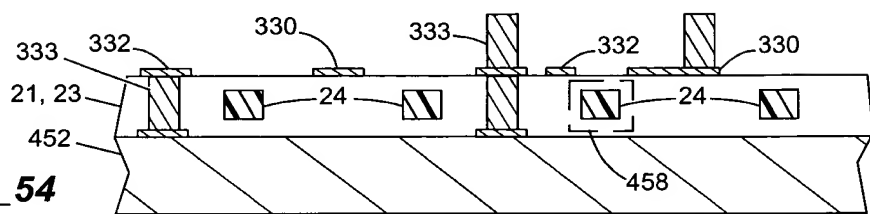


FIG._55

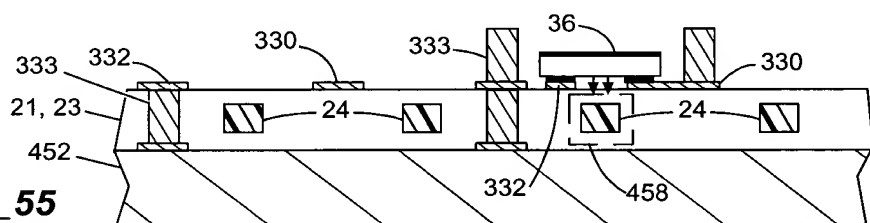


FIG._56

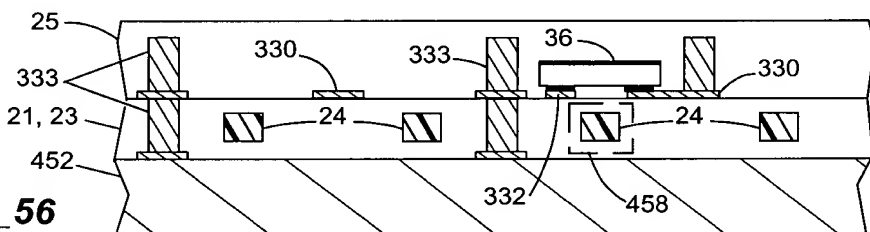


FIG._57

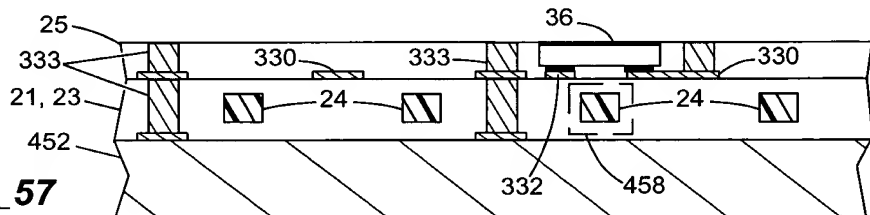
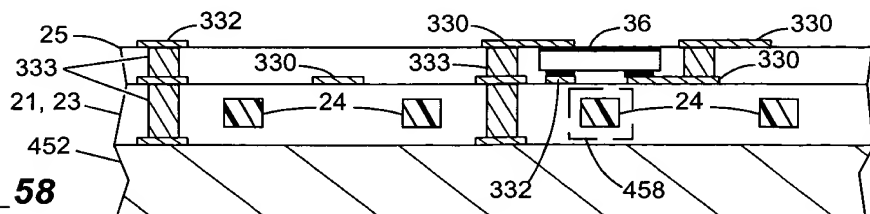
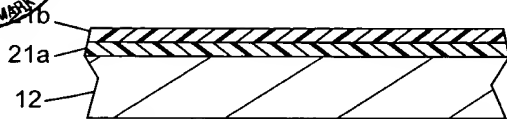
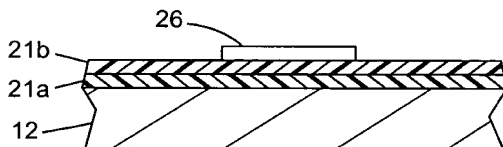
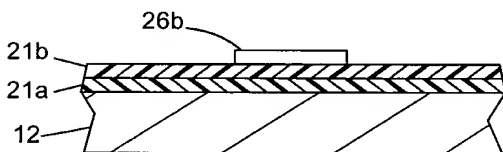
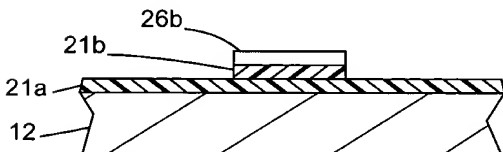
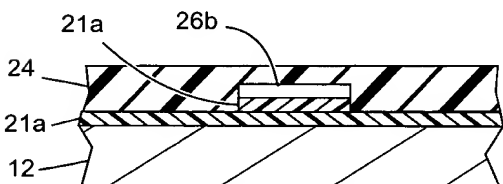
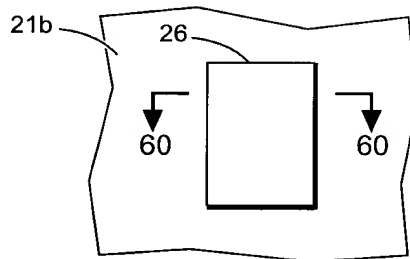
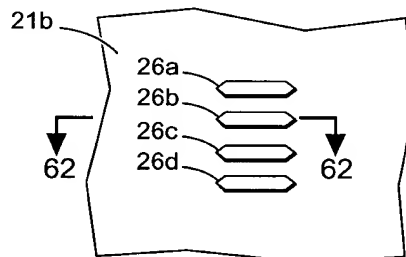


FIG._58



**FIG. 59****FIG. 60****FIG. 62****FIG. 64****FIG. 65****FIG. 61****FIG. 63**

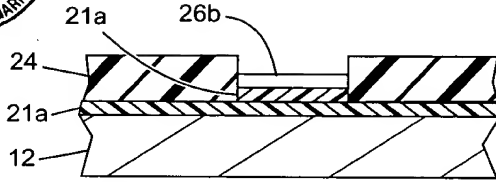


FIG. 66

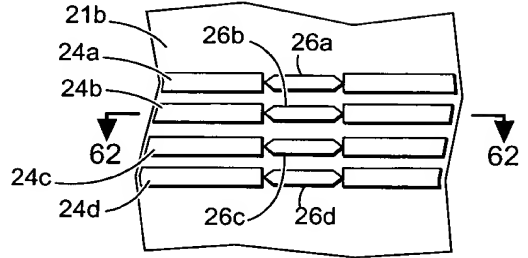


FIG. 67

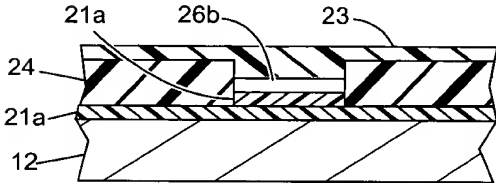


FIG. 68

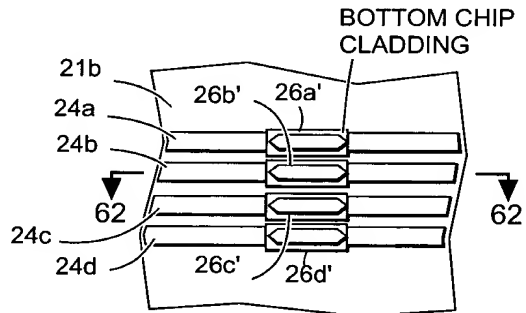
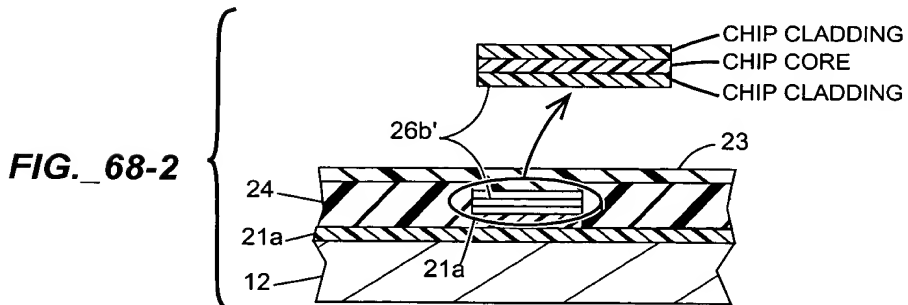
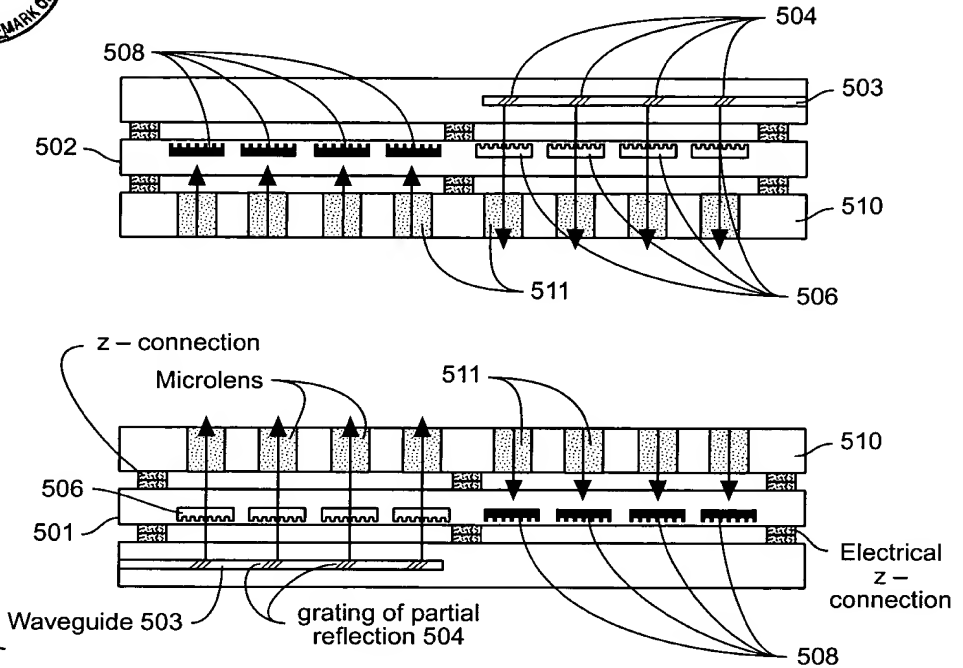
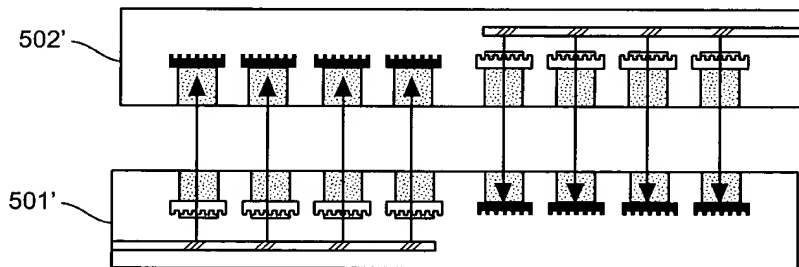


FIG. 67-2



**FIG._69****FIG._70**

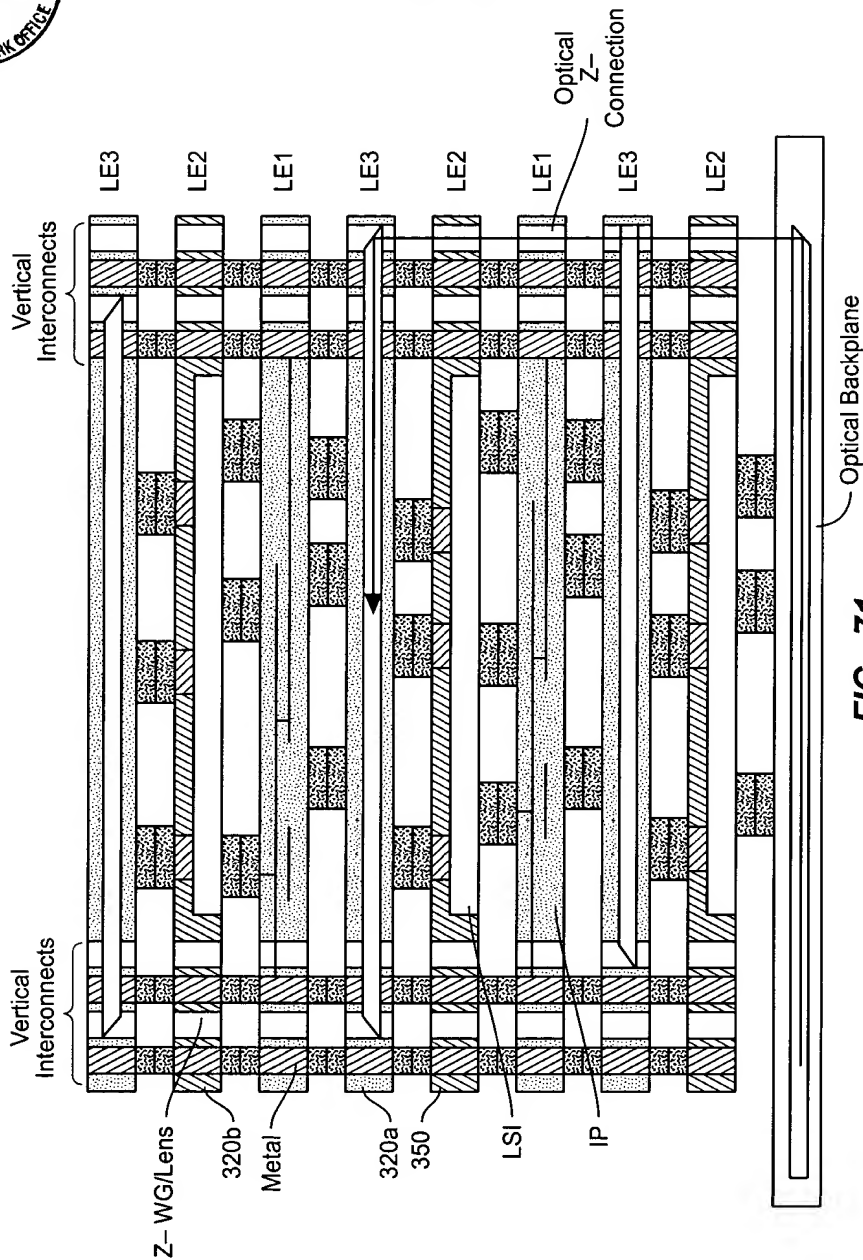
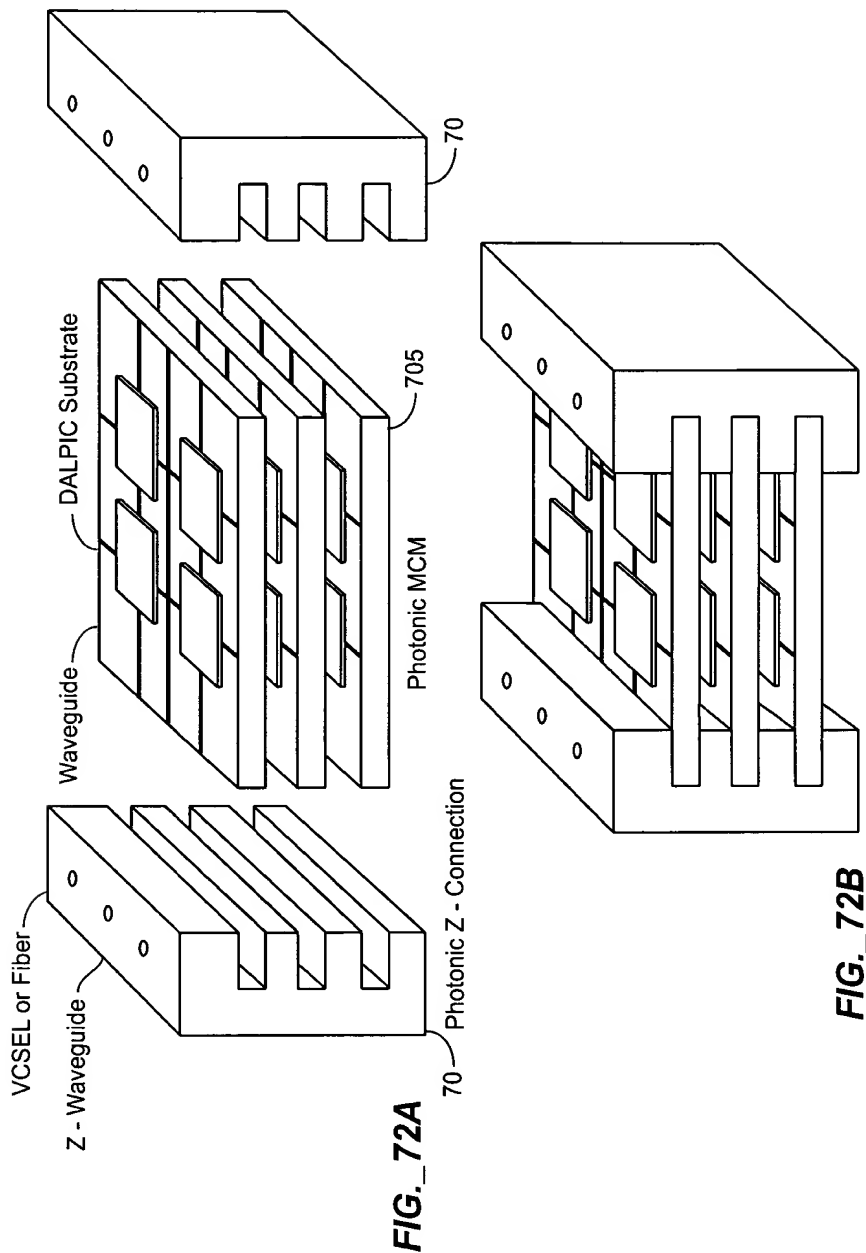


FIG. 71



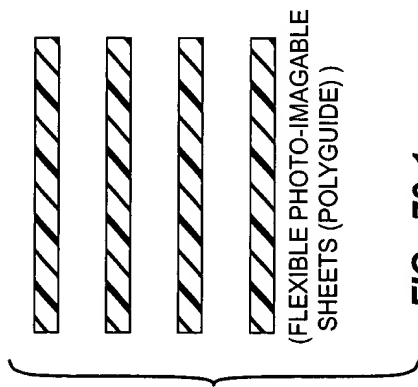


FIG. 73-1

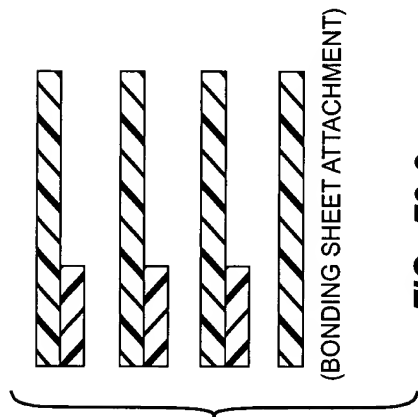


FIG. 73-2

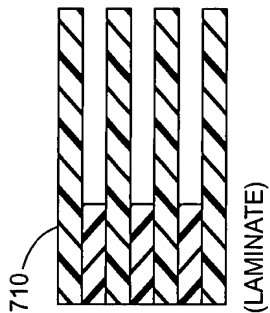


FIG. 73-3

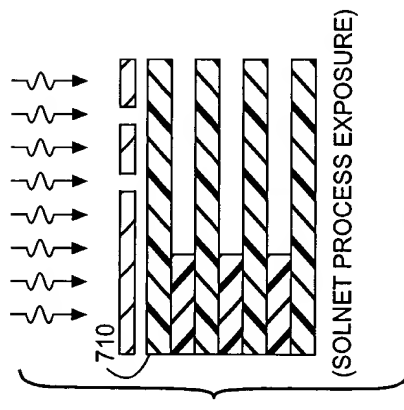


FIG. 73-4

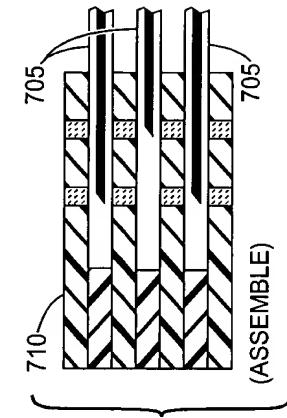


FIG. 73-6

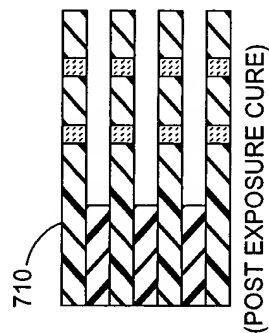
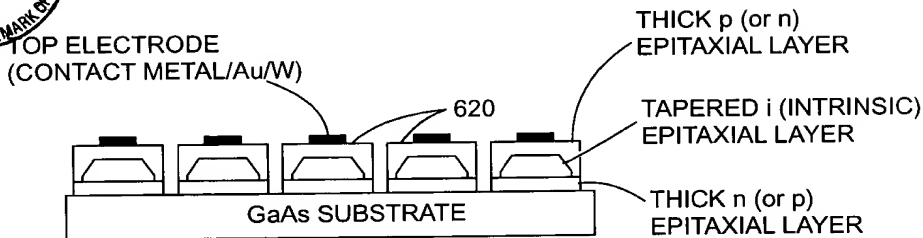
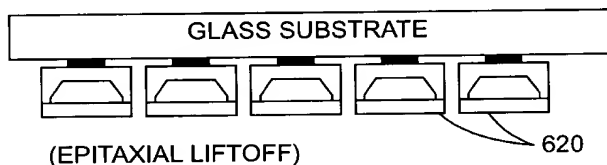


FIG. 73-5



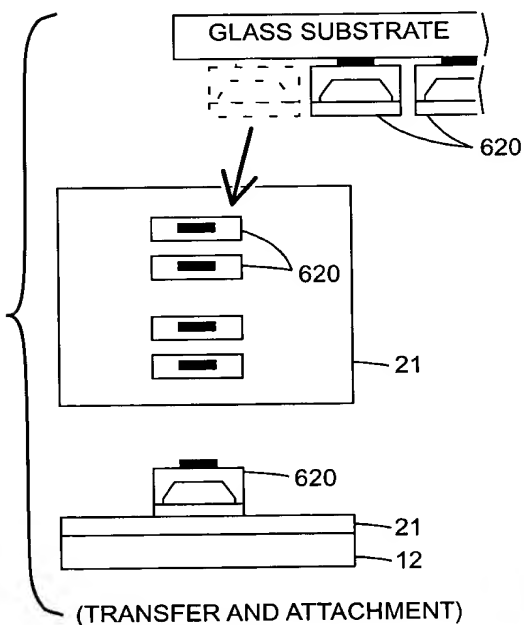
(EPITAXIAL GROWTH AND PATTERNING)

FIG. 74



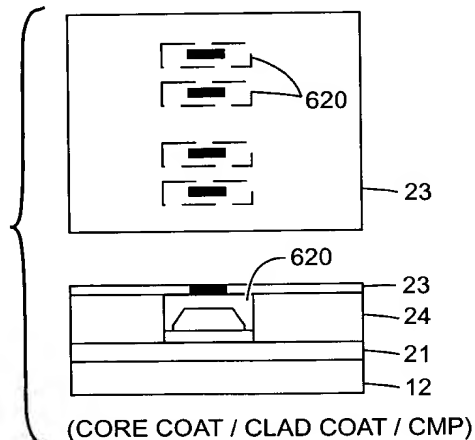
(EPITAXIAL LIFTOFF)

FIG. 75



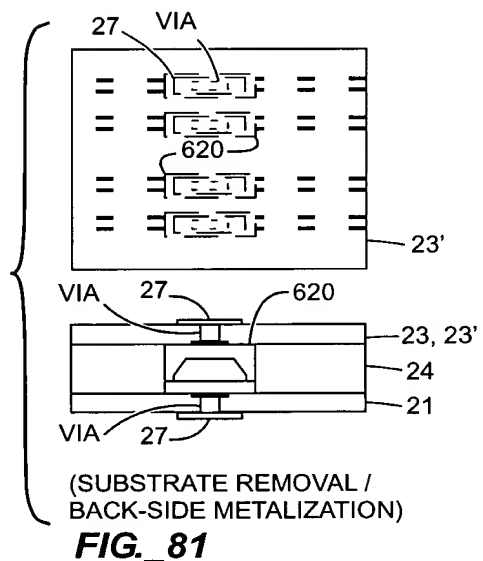
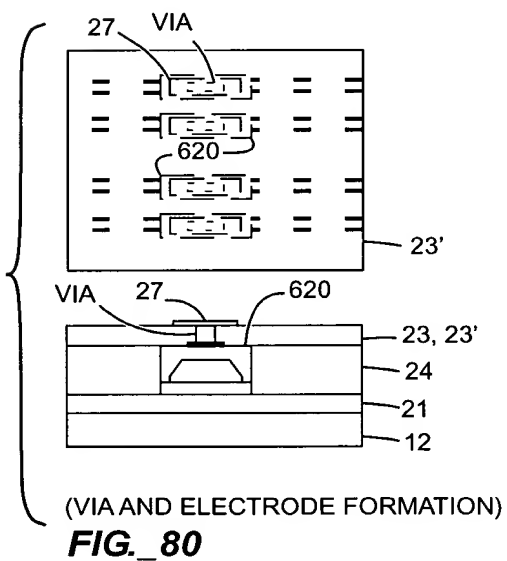
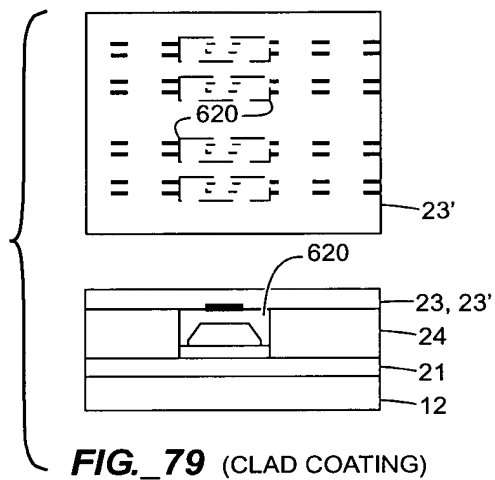
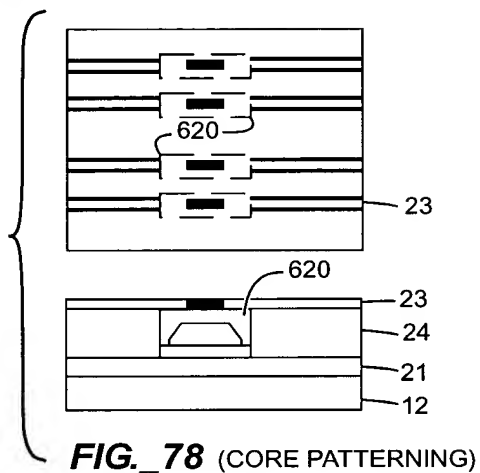
(TRANSFER AND ATTACHMENT)

FIG. 76



(CORE COAT / CLAD COAT / CMP)

FIG. 77



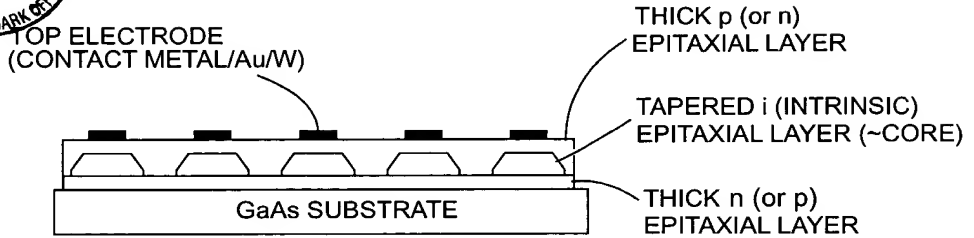


FIG. 82
(EPITAXIAL GROWTH)

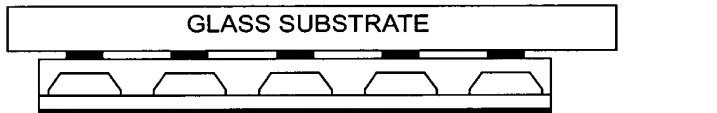


FIG. 83
(EPITAXIAL LIFTOFF AND METALIZATION)

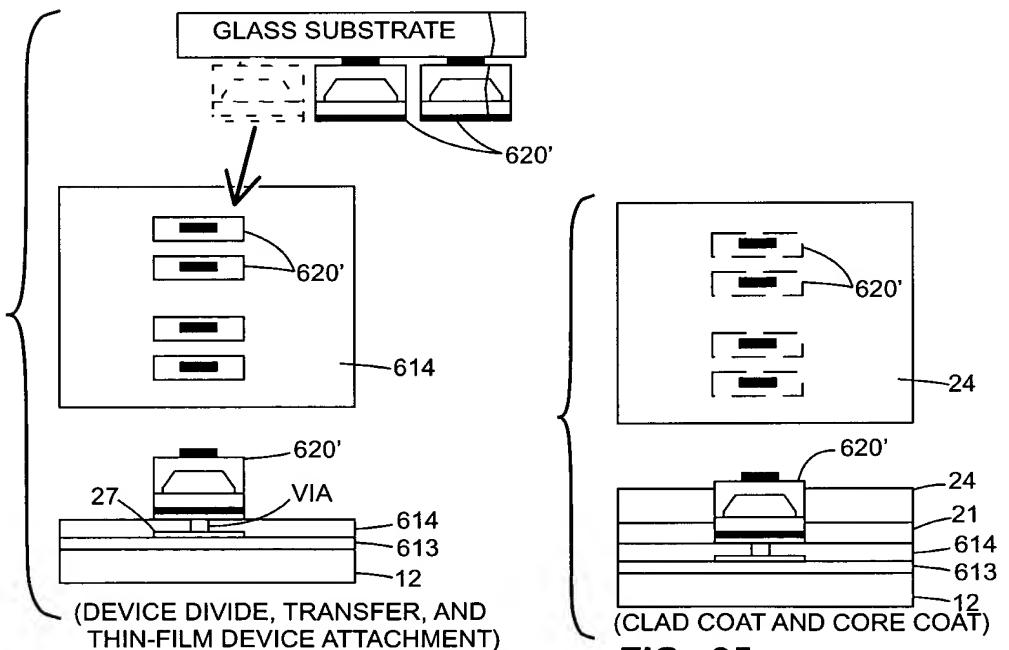


FIG. 84

FIG. 85



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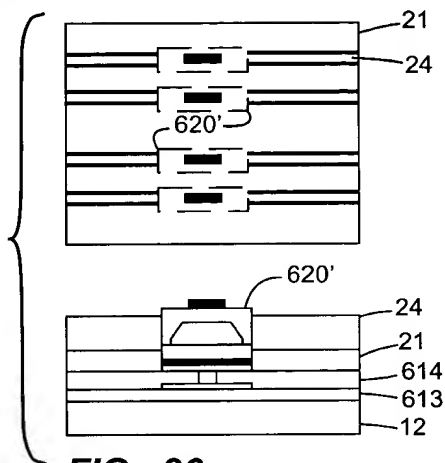


FIG. 86 (CORE PATTERNING)

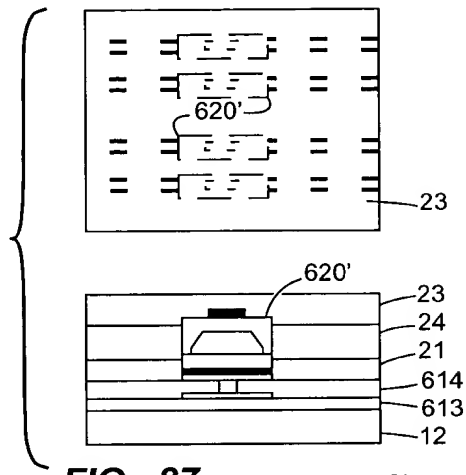


FIG. 87 (CLAD COATING)

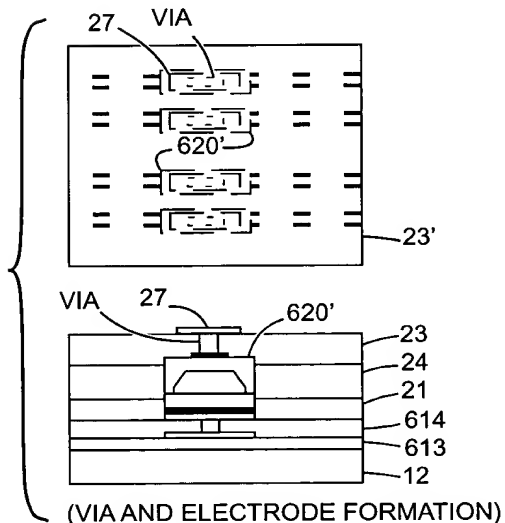


FIG. 88 (VIA AND ELECTRODE FORMATION)

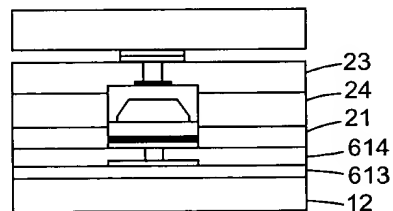
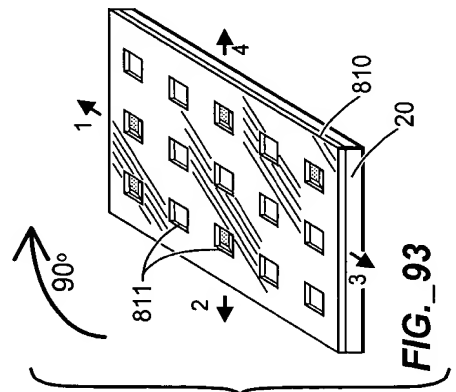
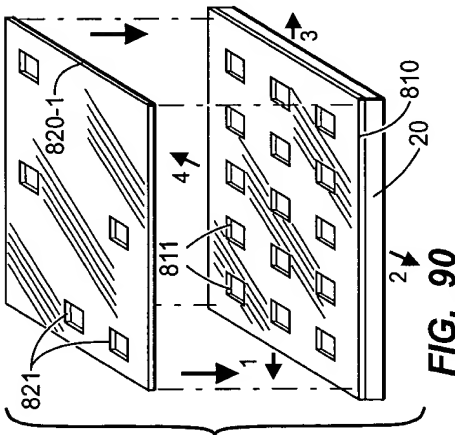
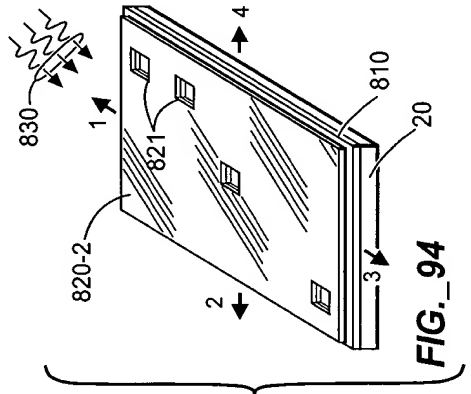
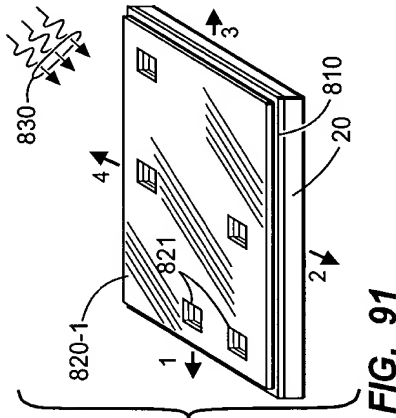
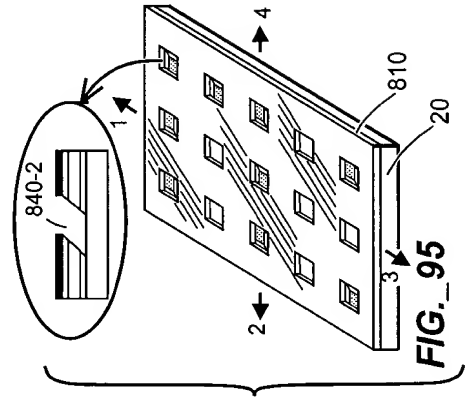
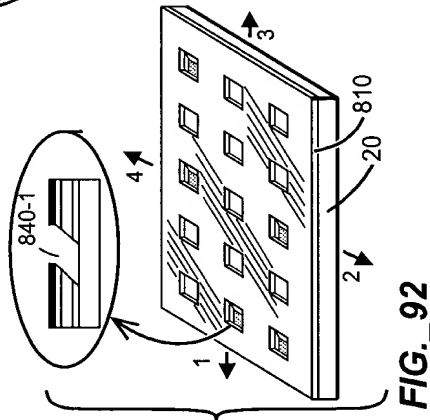


FIG. 89



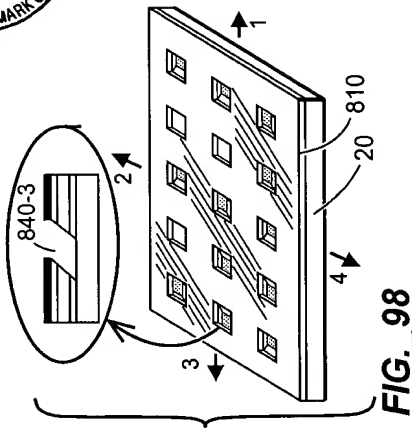


FIG. 96

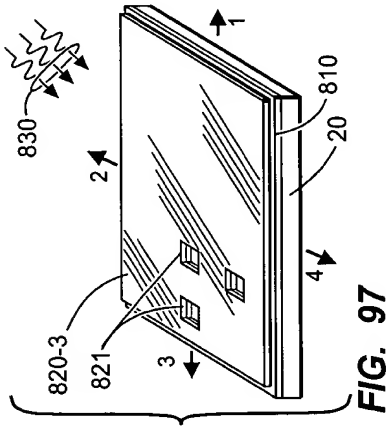


FIG. 97

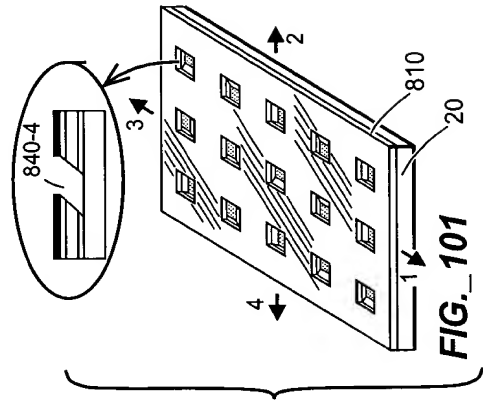


FIG. 98

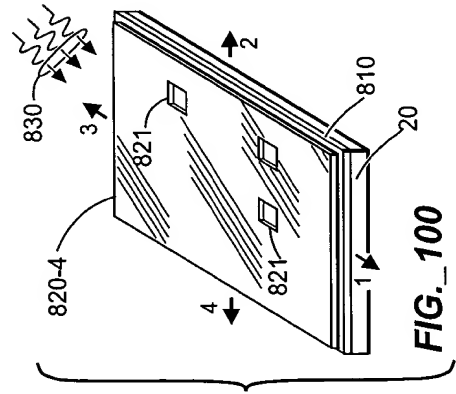


FIG. 99

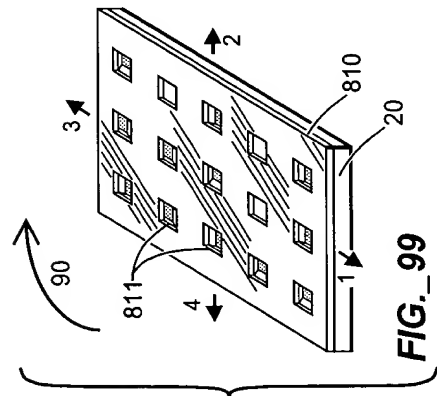
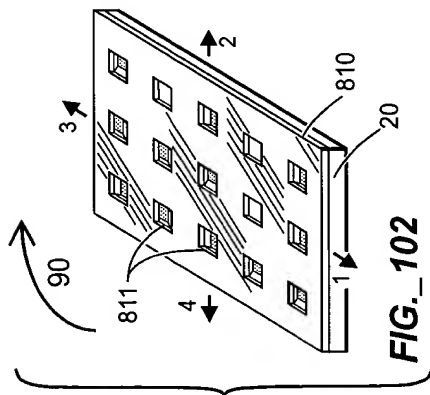
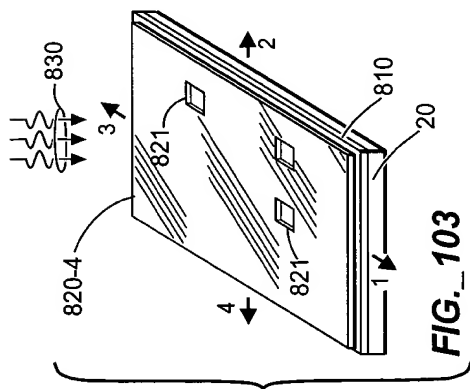
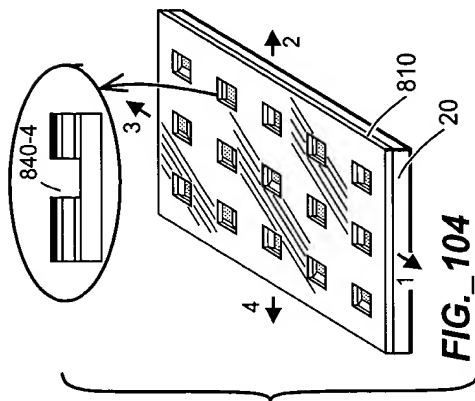


FIG. 100



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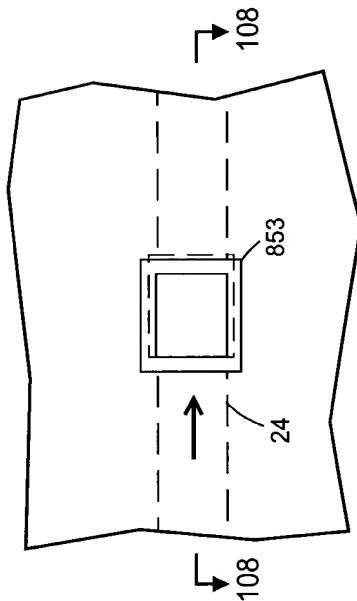


FIG. 107

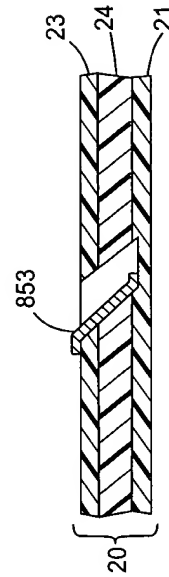


FIG. 108

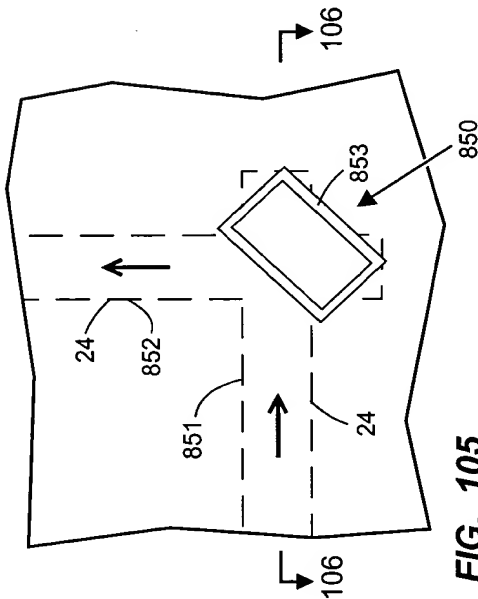


FIG. 105

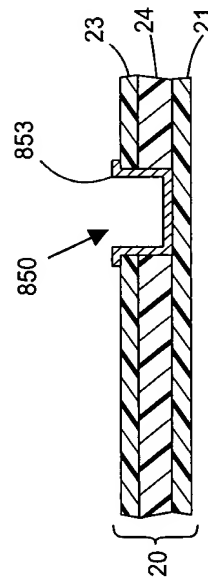


FIG. 106

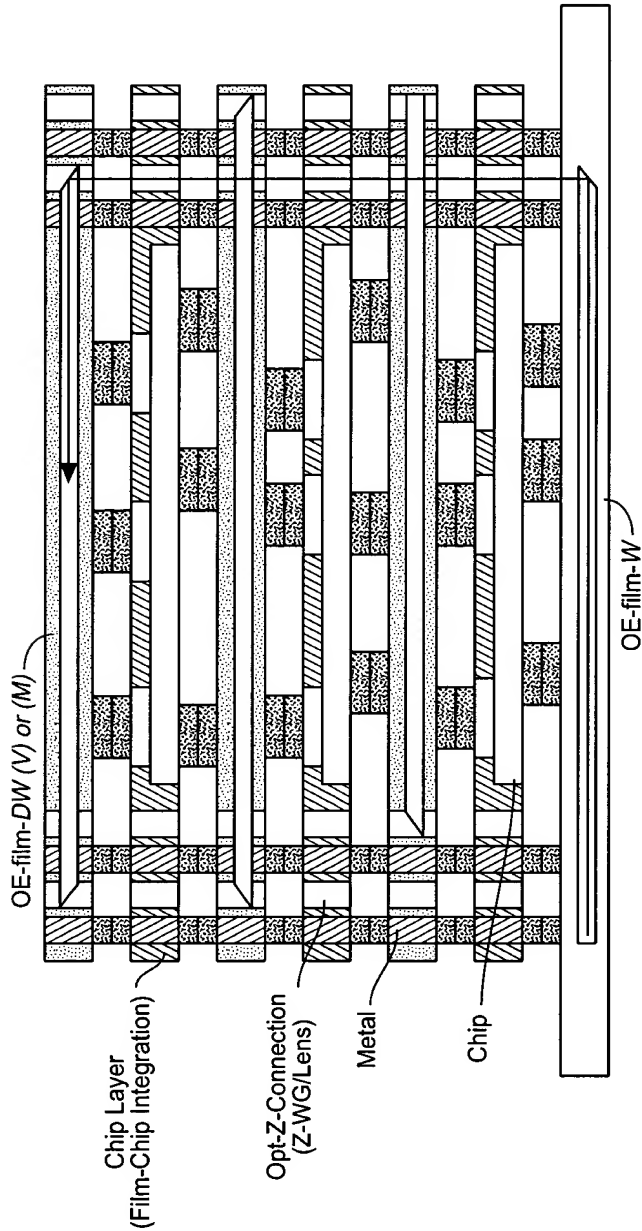


FIG. 109

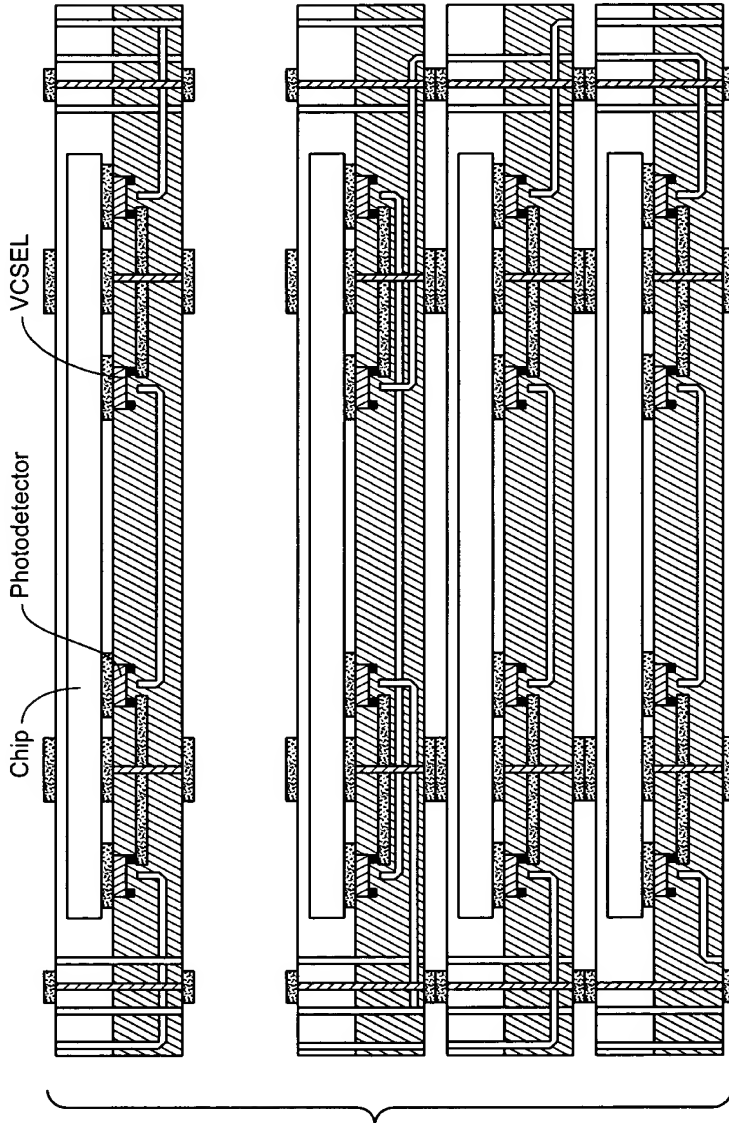
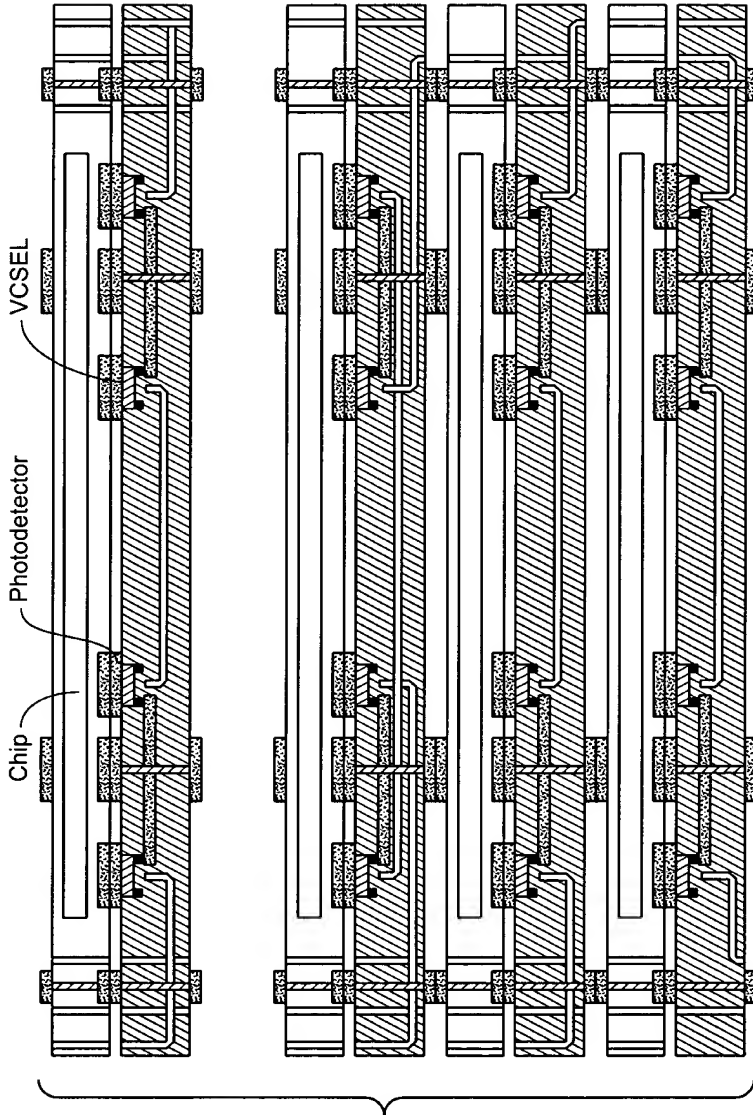


FIG. 110



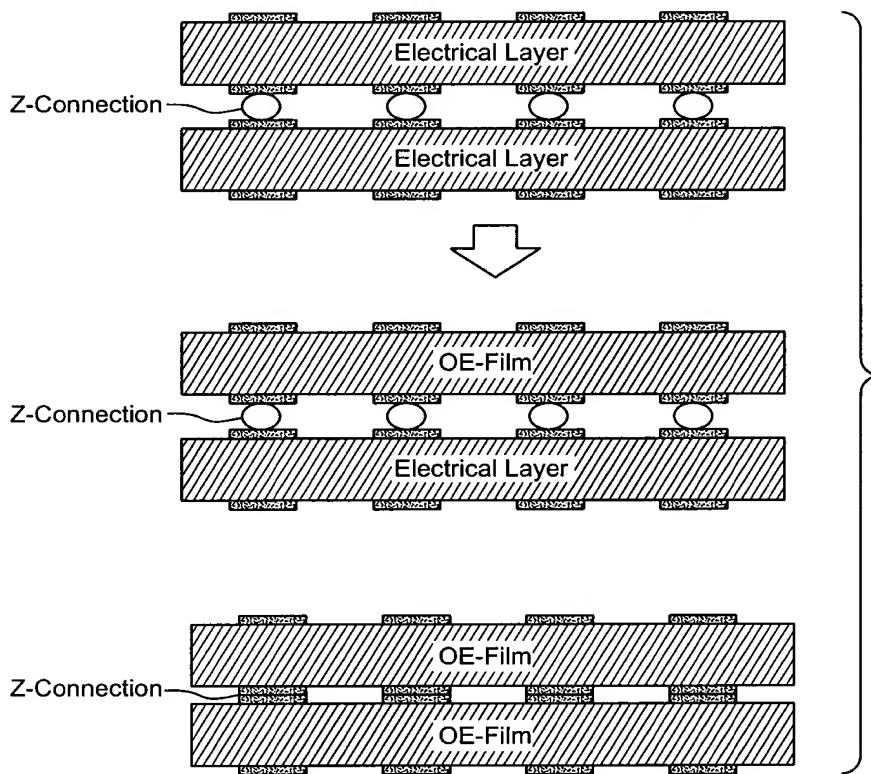
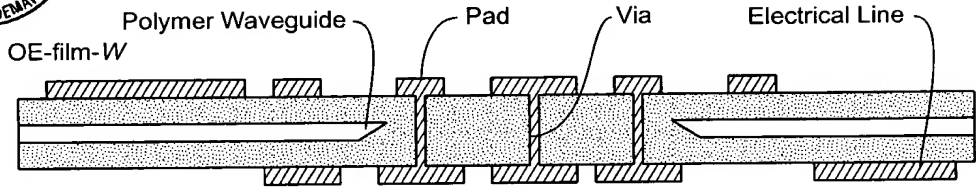
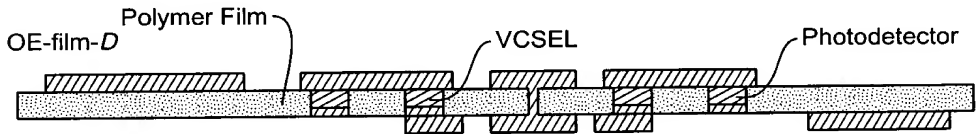
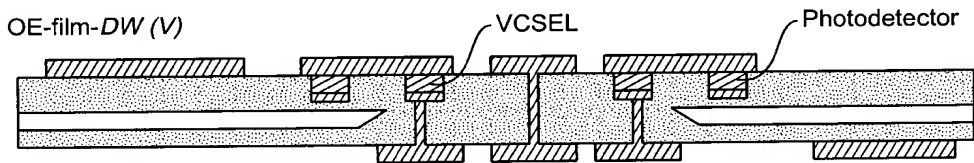
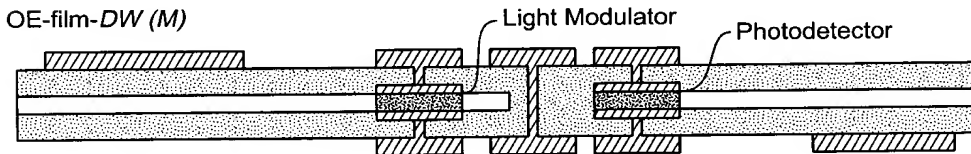


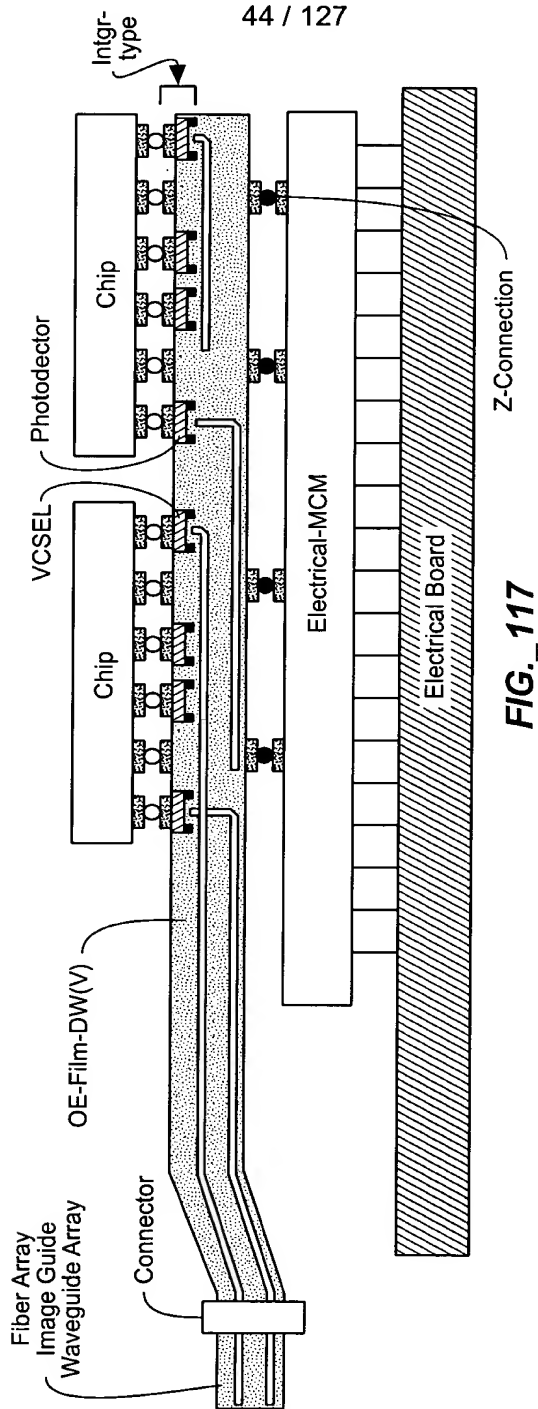
FIG. 112

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**FIG. 113****FIG. 114****FIG. 115****FIG. 116**



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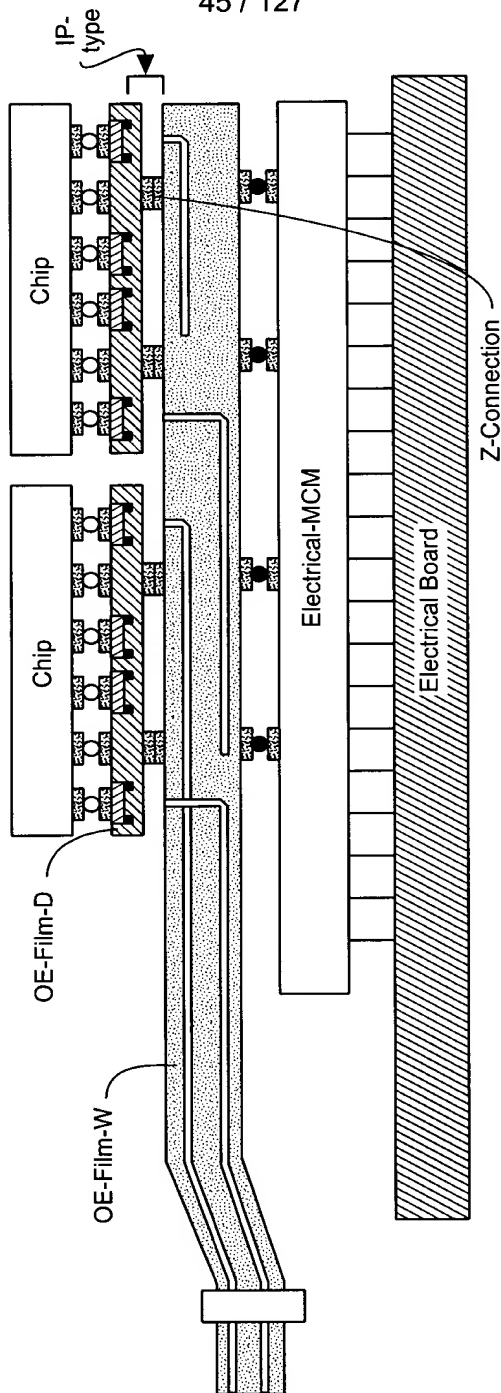


FIG._118

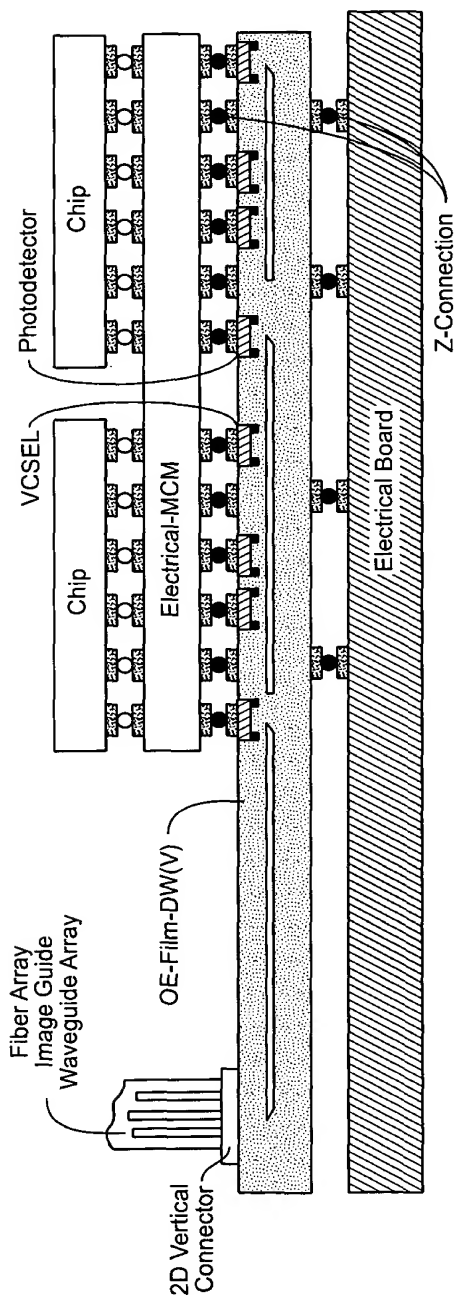


FIG. 119



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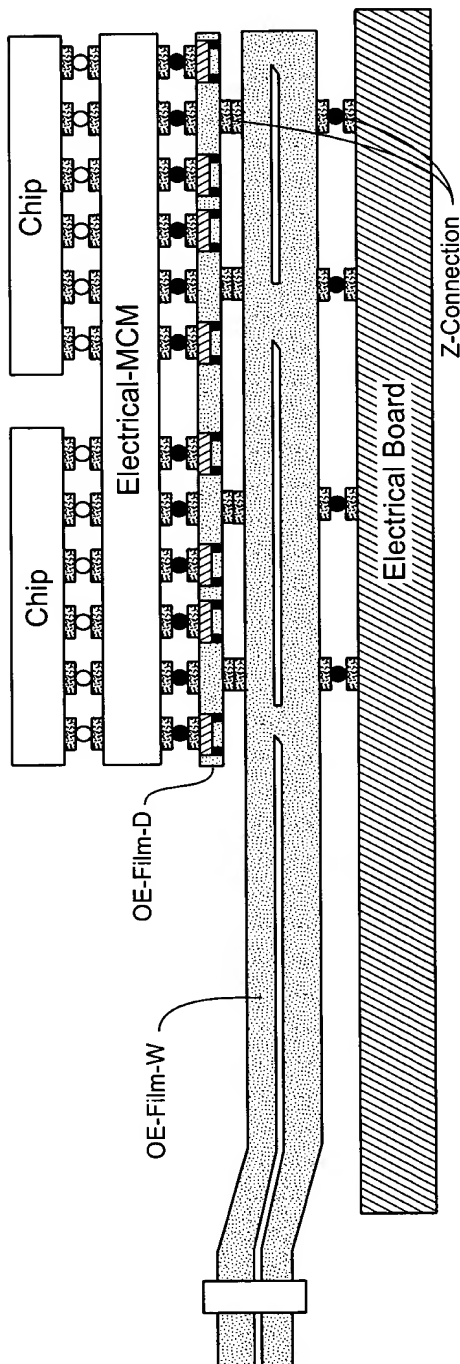


FIG. 120

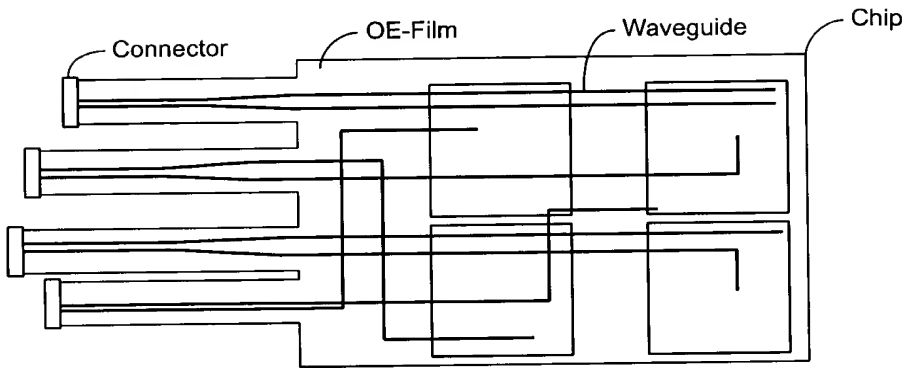


FIG. 121

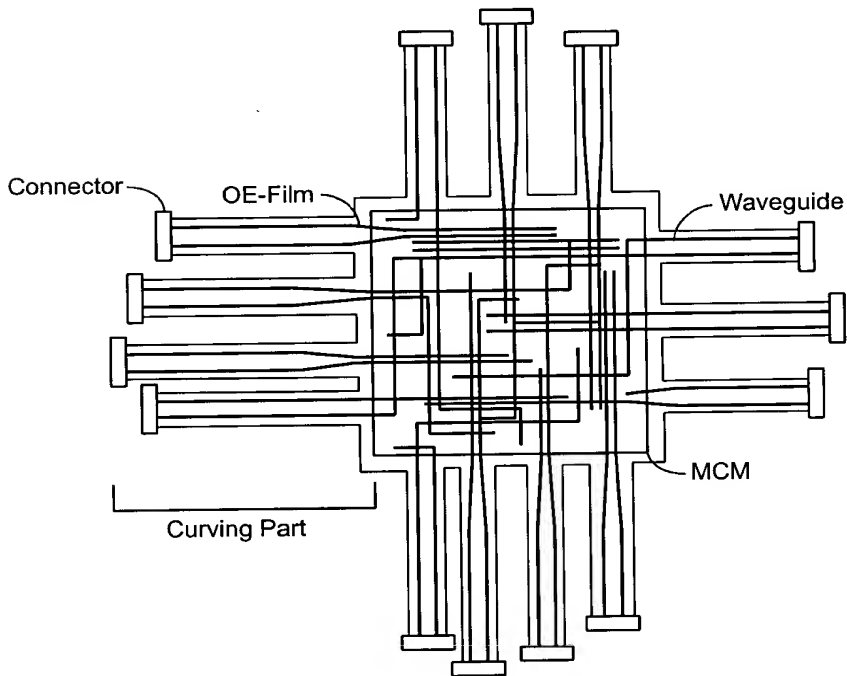


FIG. 122



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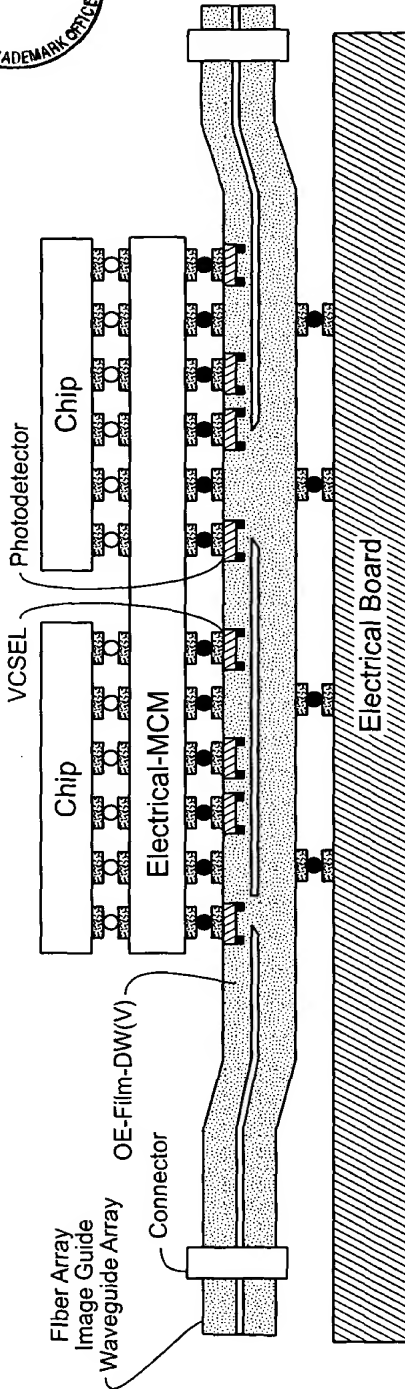


FIG. 123

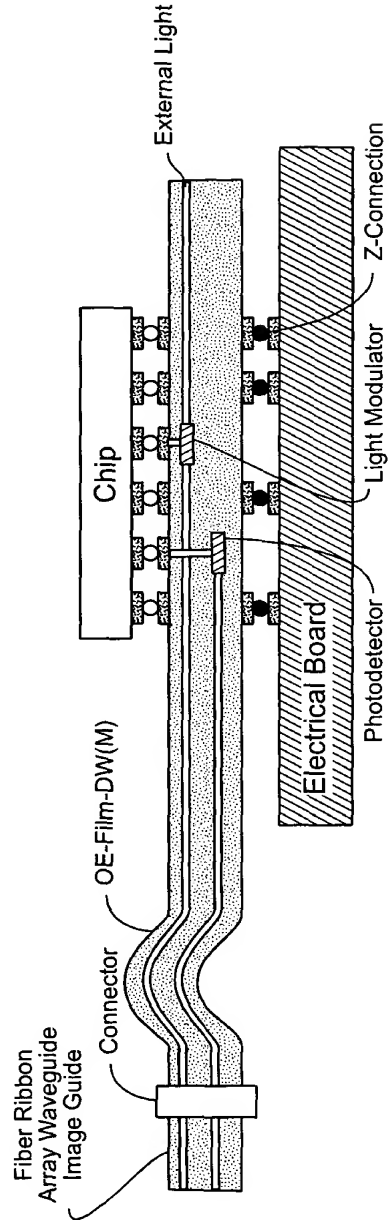


FIG. 125

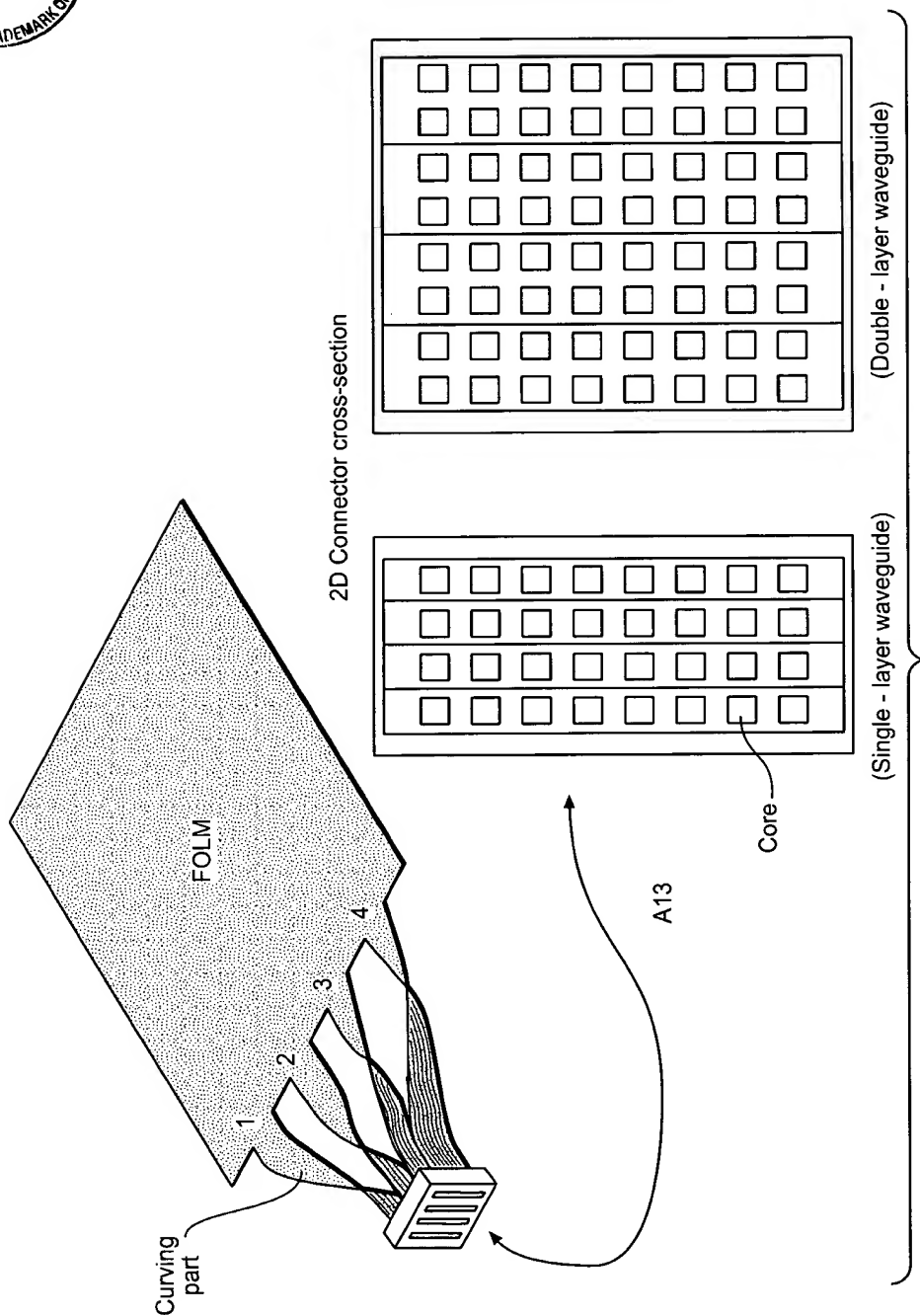


FIG. 124

Through Put: 1.5 pbs x 196 ch Assume SSX MCM Size is ~ 5cm x 5cm

Unit: unknown

FIG. 126

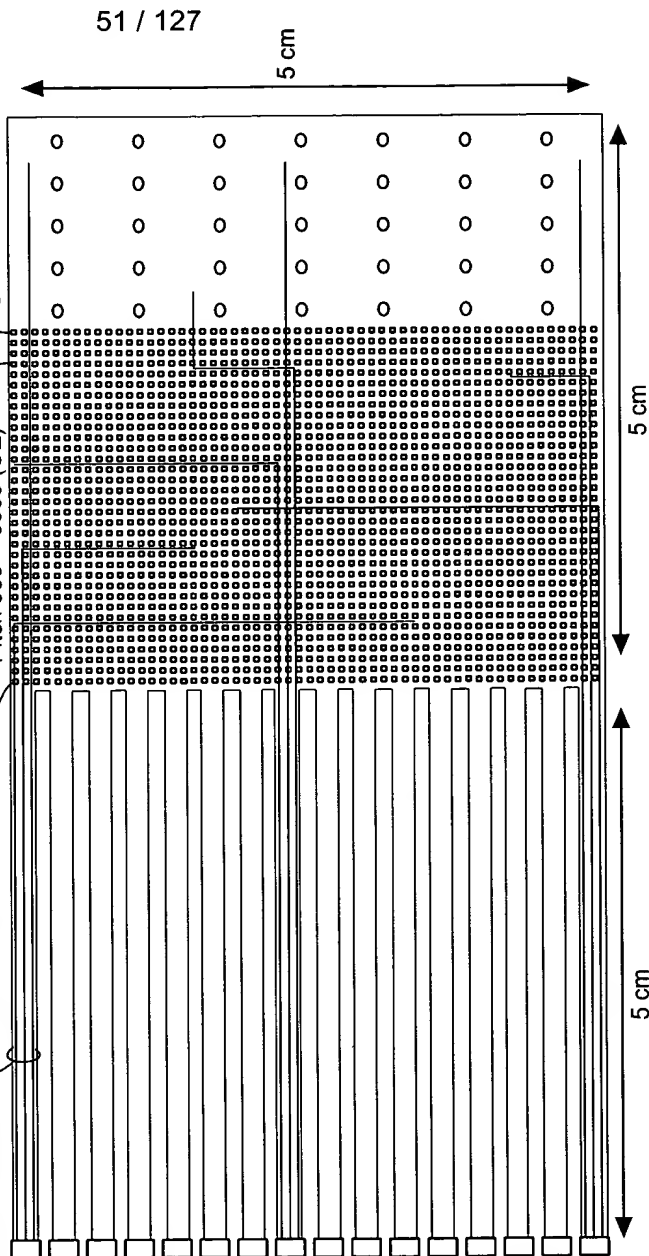
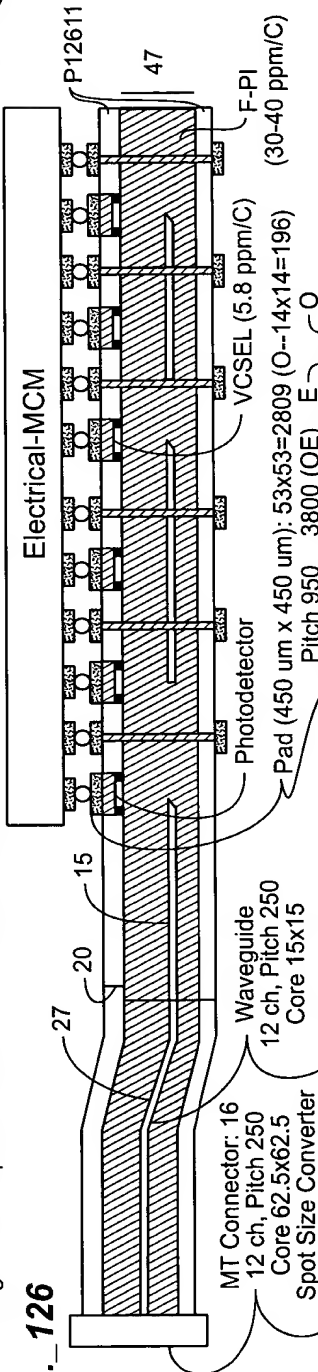


FIG. 127



FIG. 129

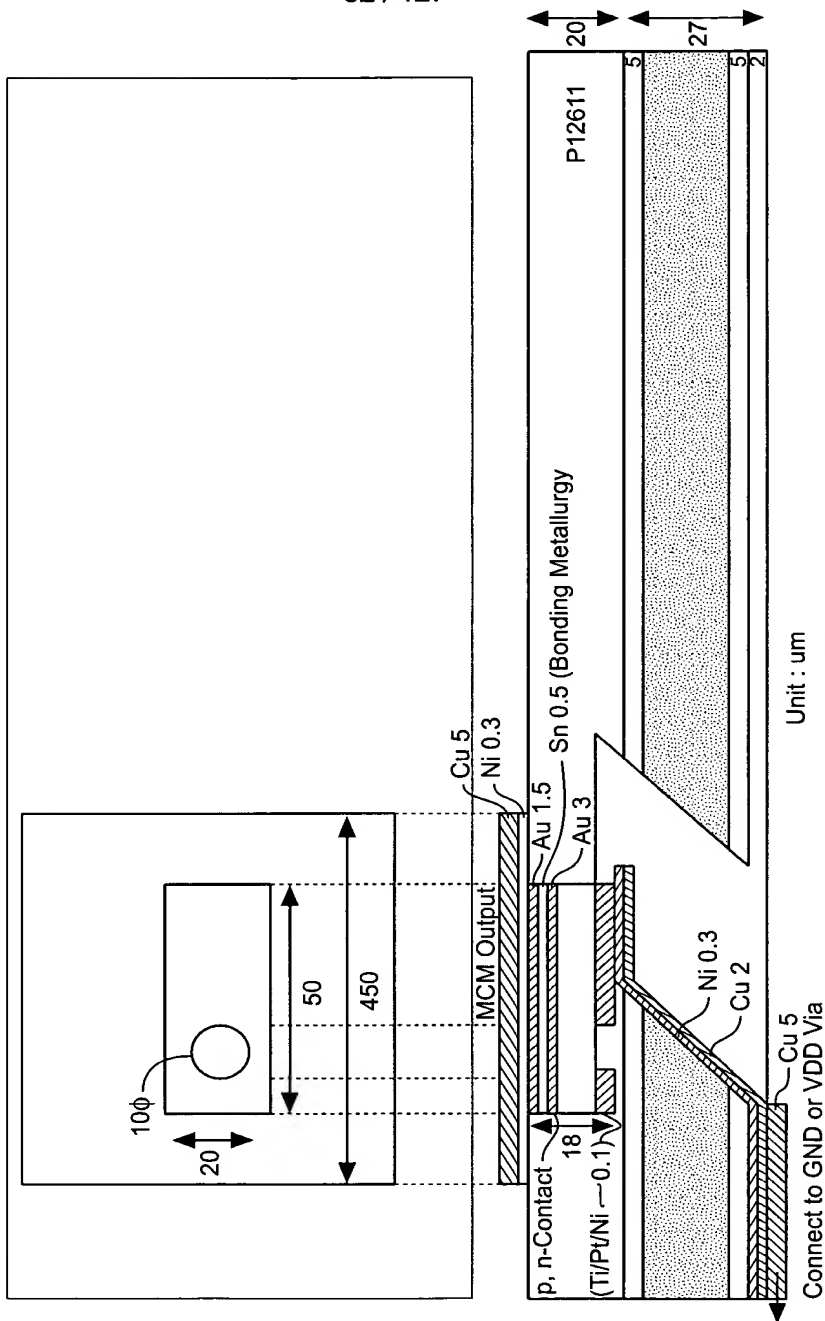


FIG. 128

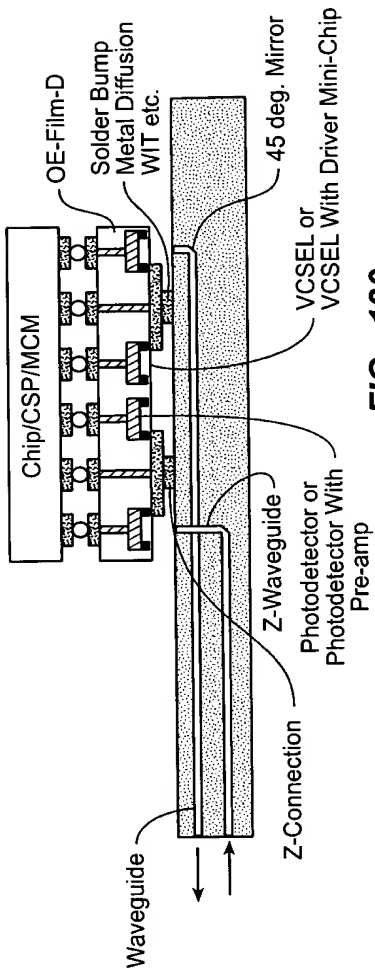


FIG. 130

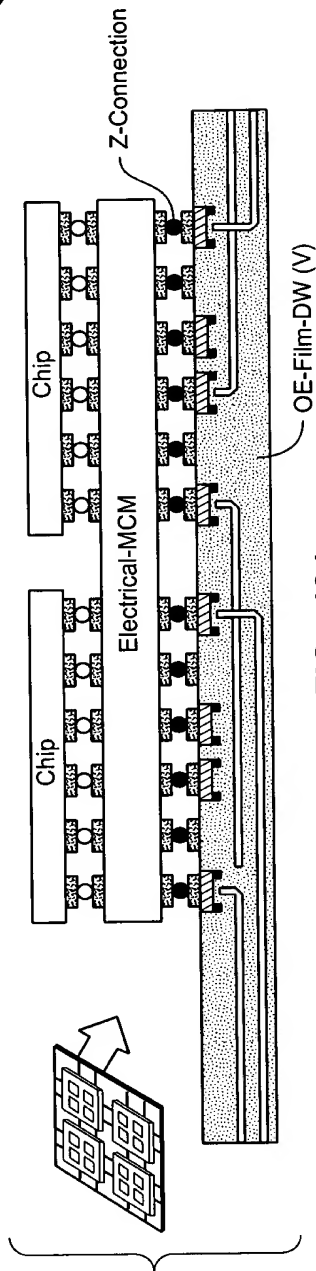


FIG. 131



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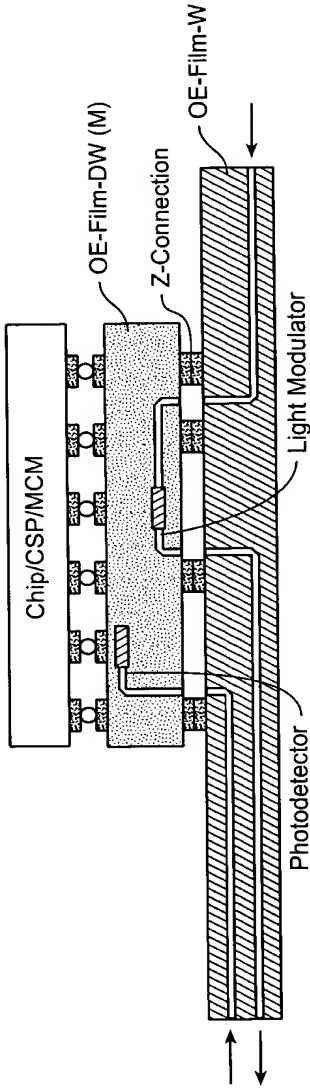


FIG._132

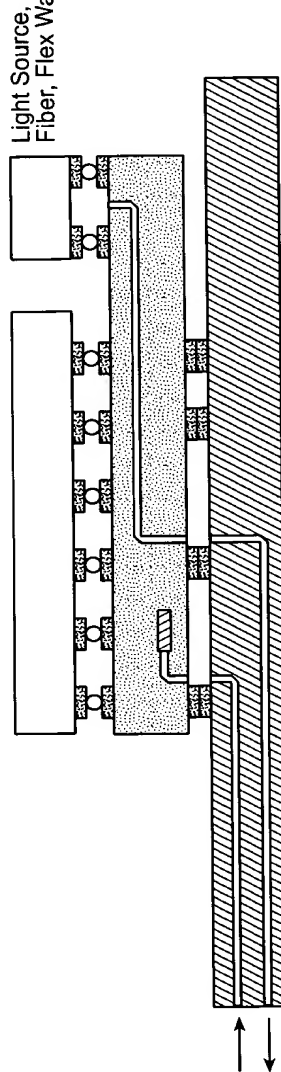


FIG._133

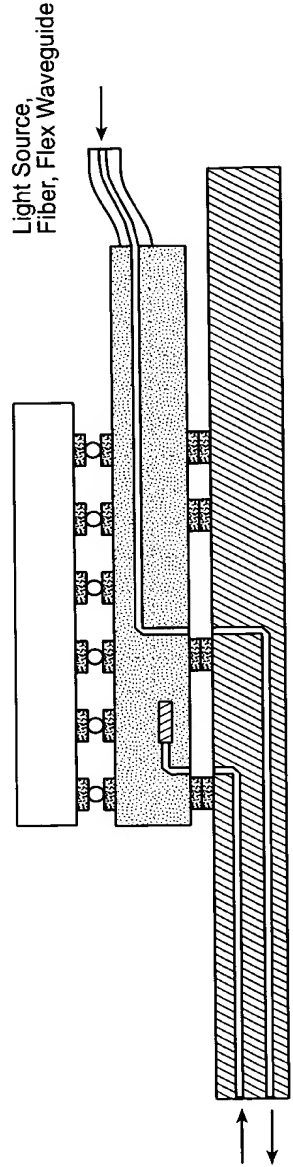
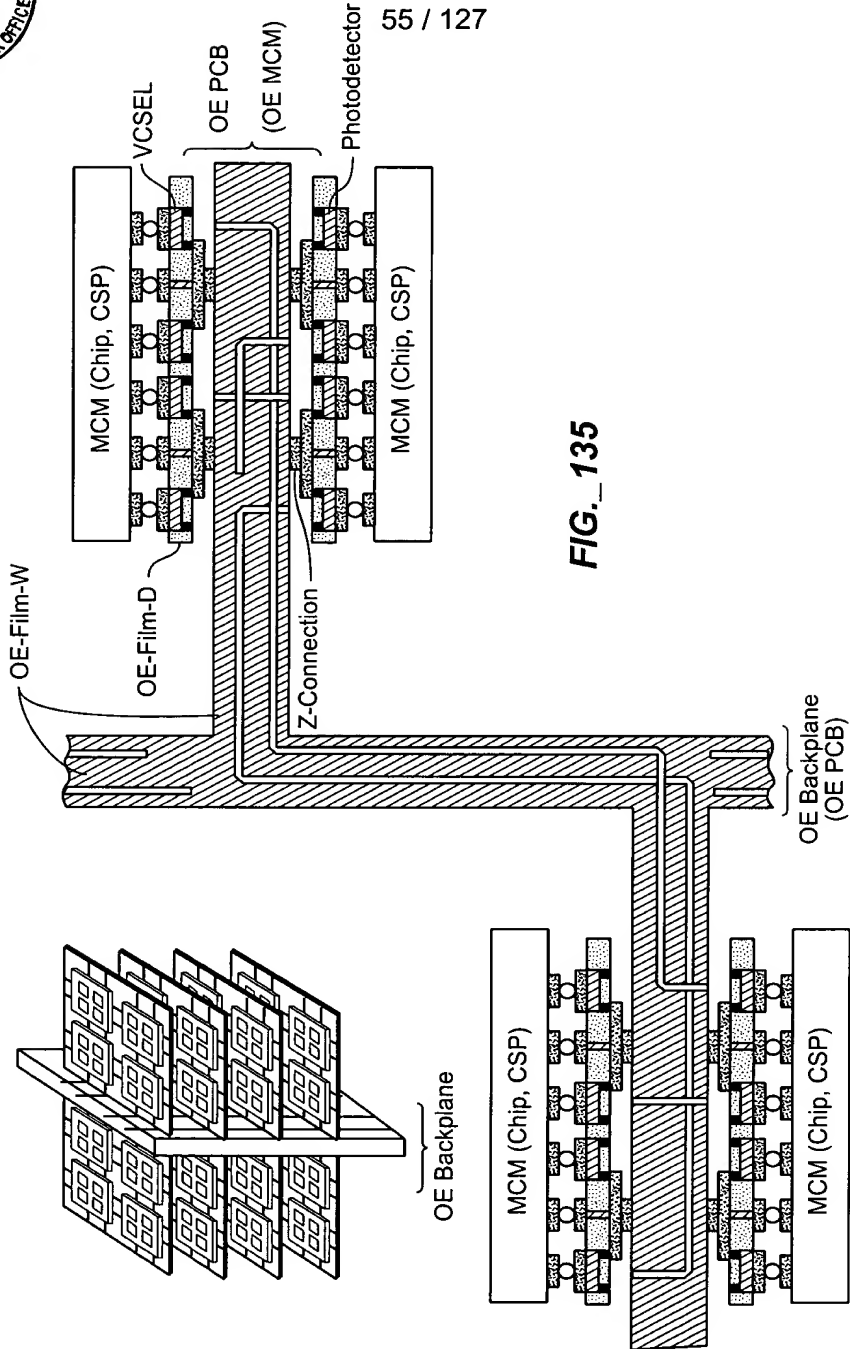
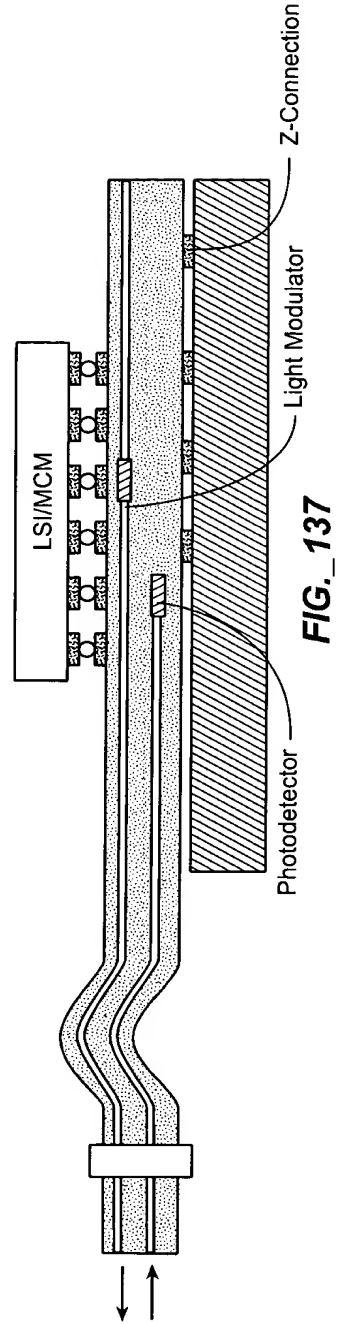
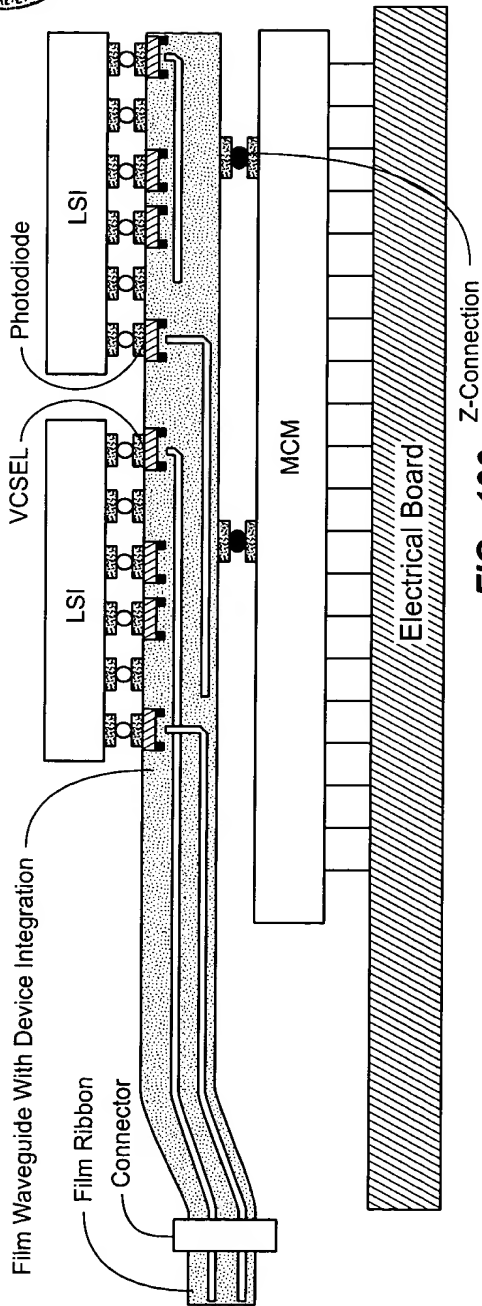


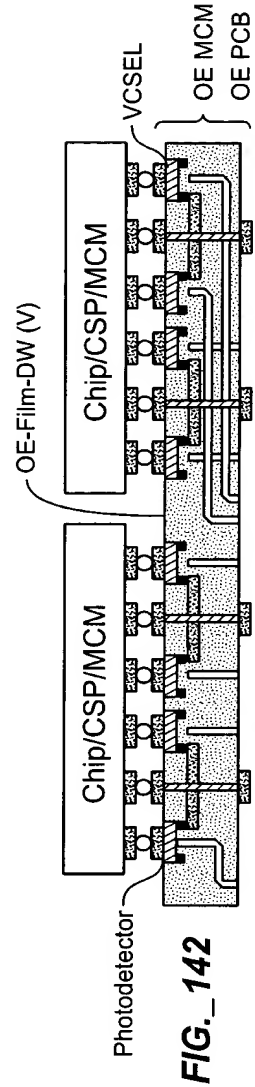
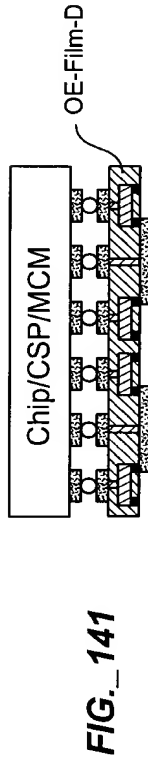
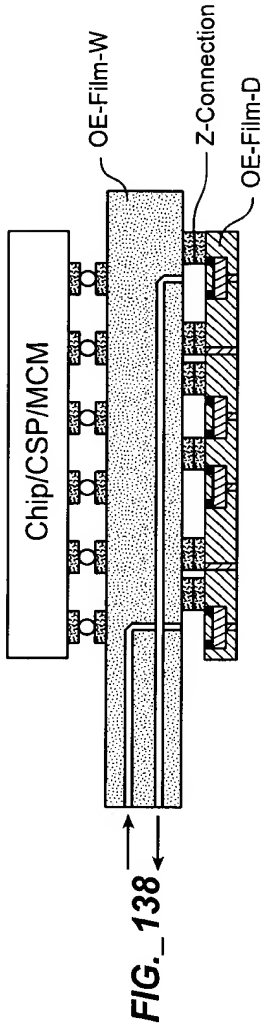
FIG._134



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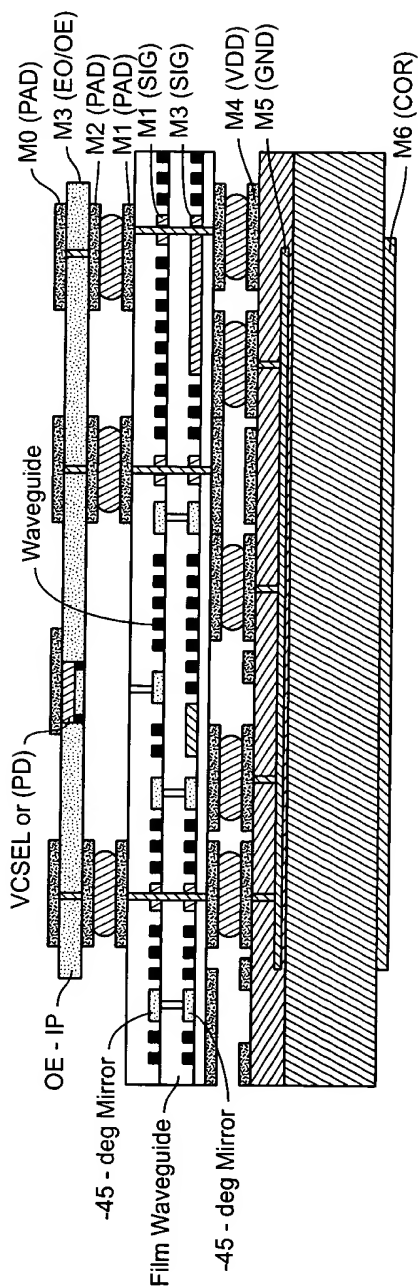


FIG. 139

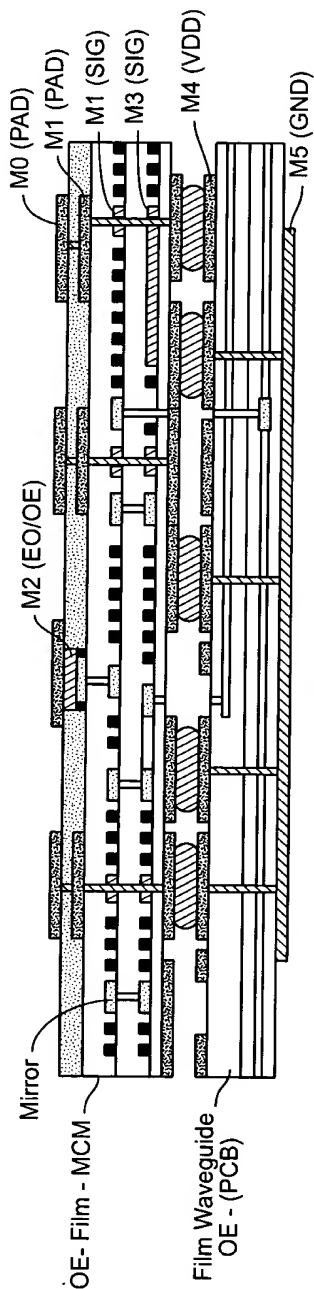
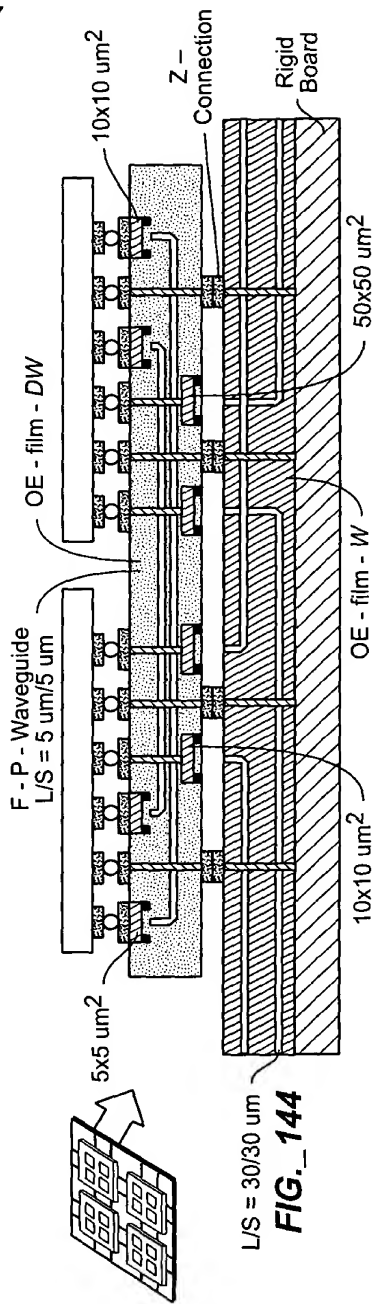
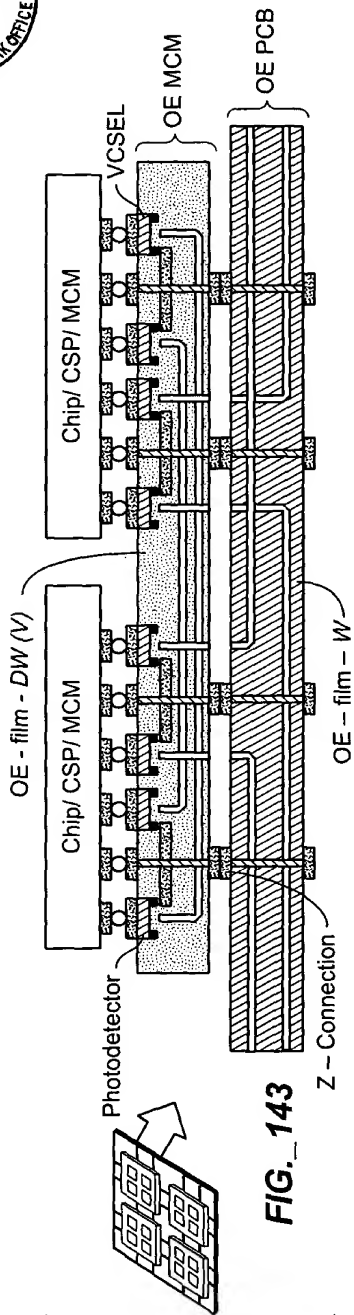


FIG. 140



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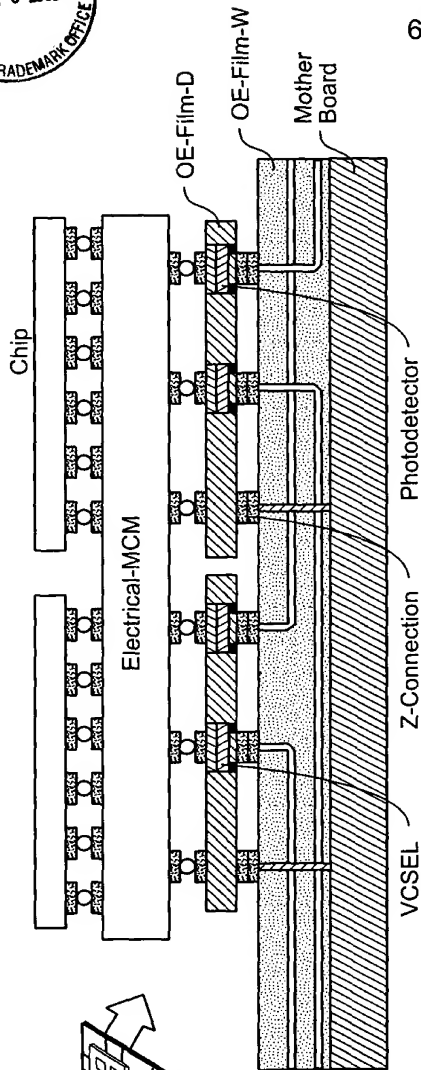


FIG. 145

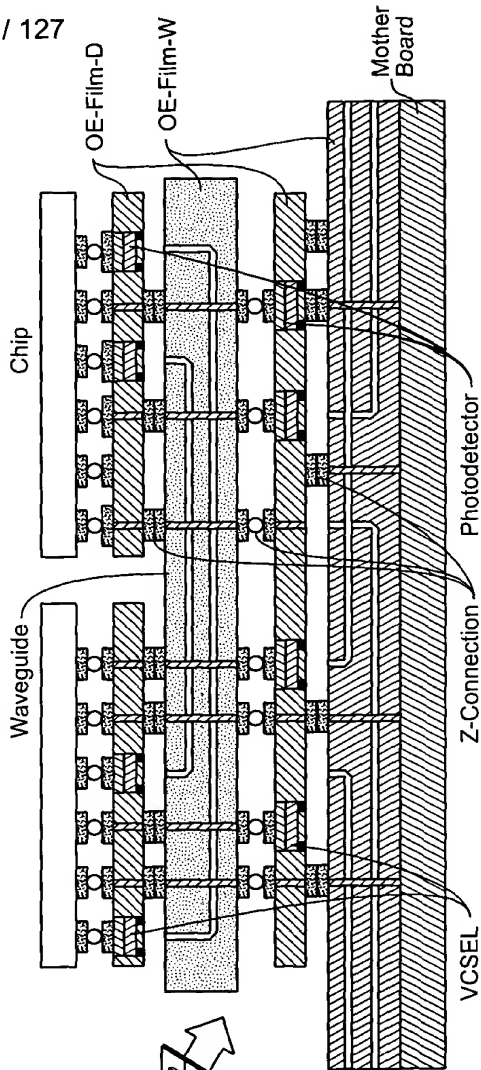


FIG. 146



FIG. 147

(PADS/LINES FORMATION)

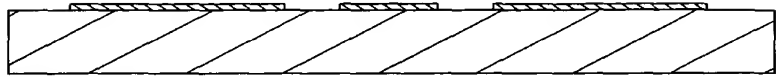


FIG. 148

(PLACEMENT OF THIN-FILM DEVICES)

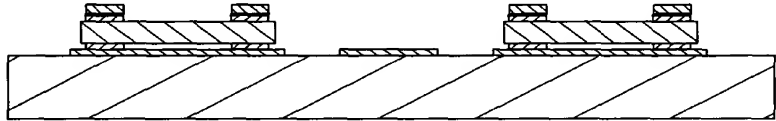


FIG. 149

(POLYMER COAT)



FIG. 150

(PLANARIZATION)

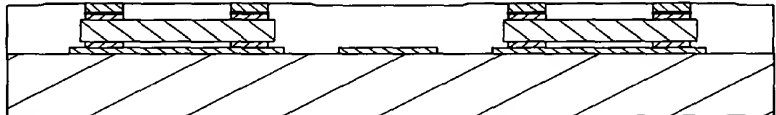


FIG. 151

(VIAS/PADS/LINES FORMATION)

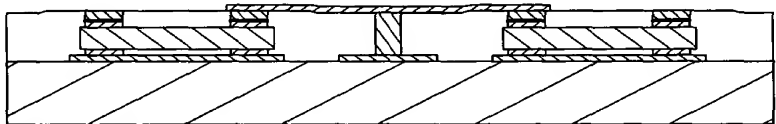


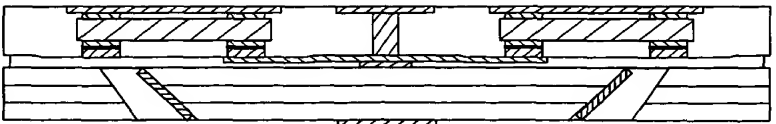
FIG. 152

(SUBSTRATE REMOVAL)



FIG. 153

(WAVEGUIDE FORMATION)



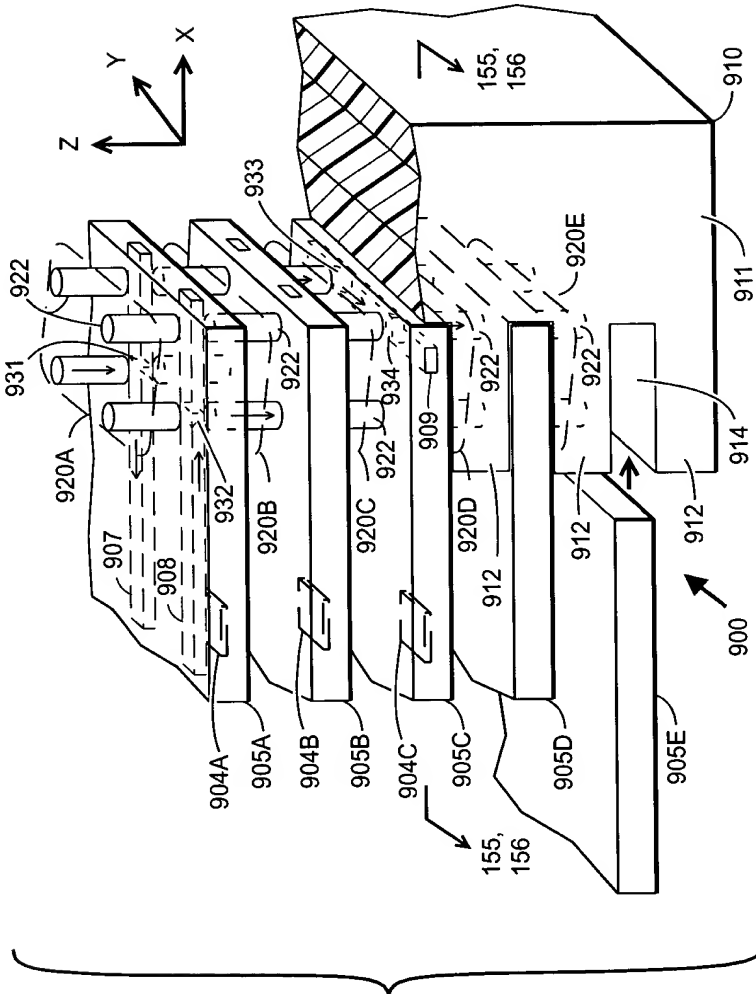


FIG. 154

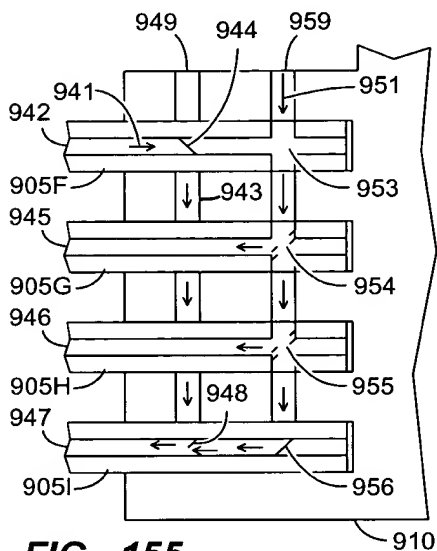


FIG. 155

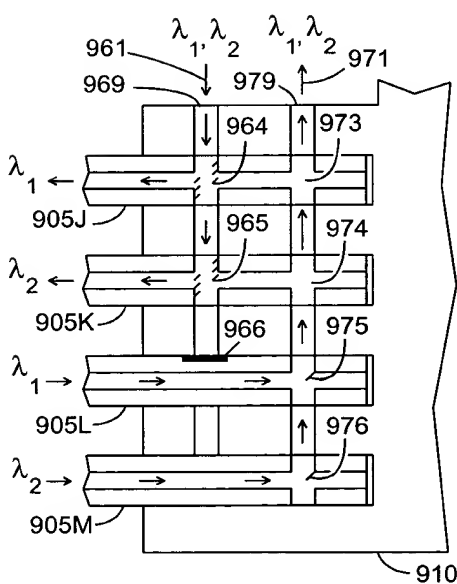


FIG. 156-1

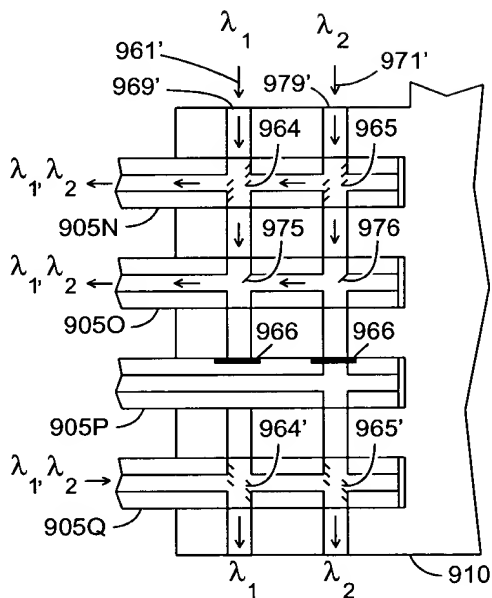


FIG. 156-2

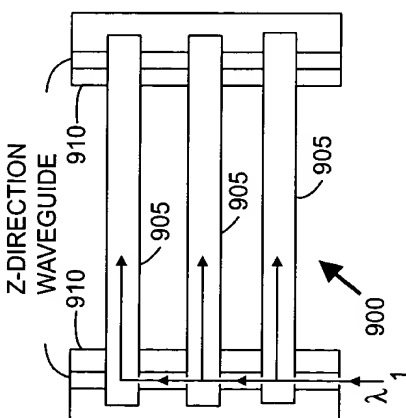
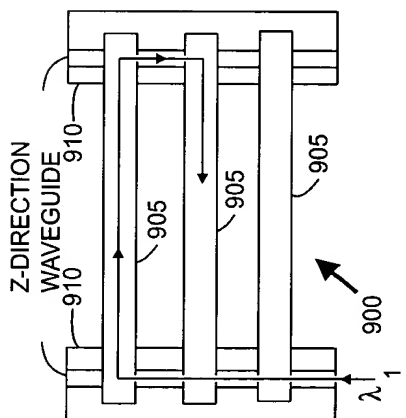
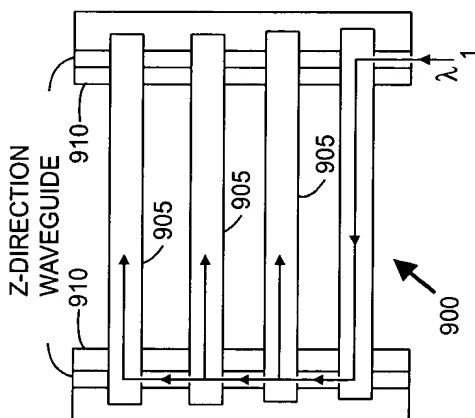
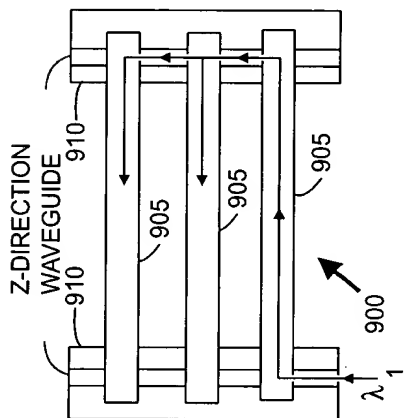
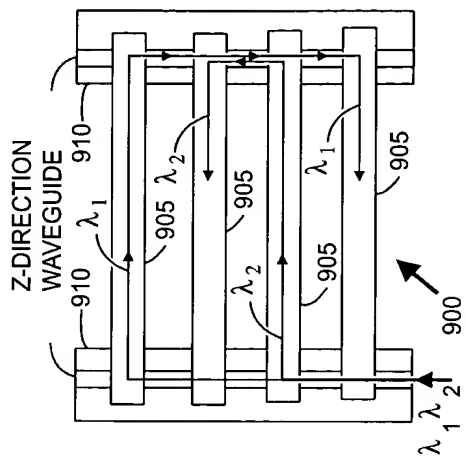
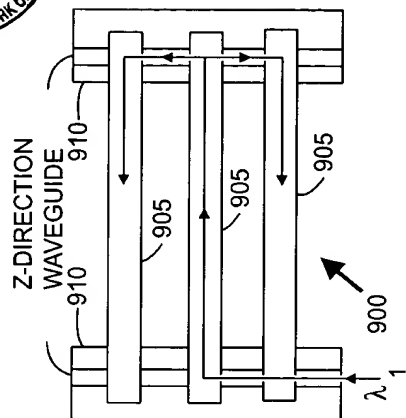


FIG. 157

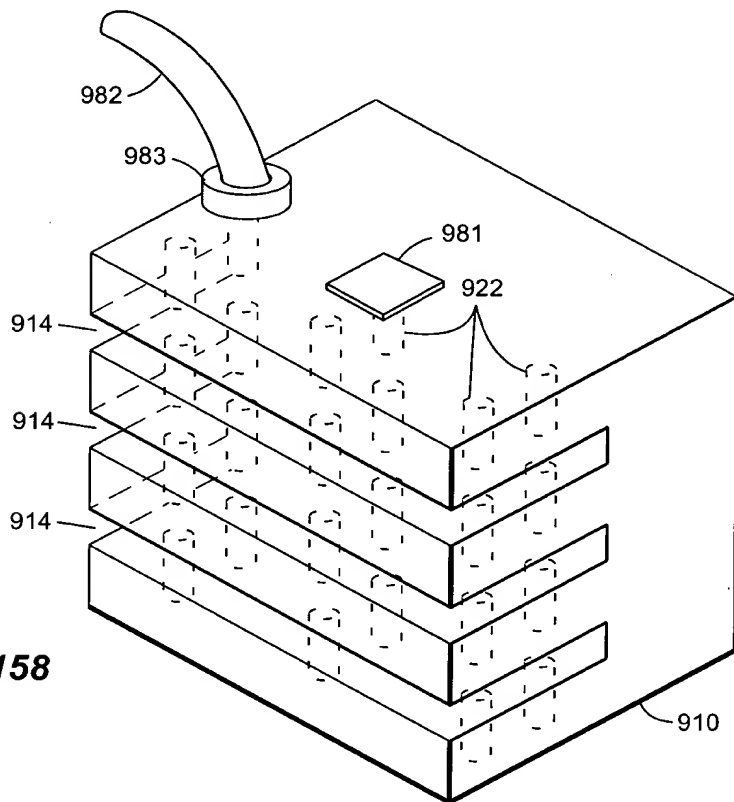


FIG. 158

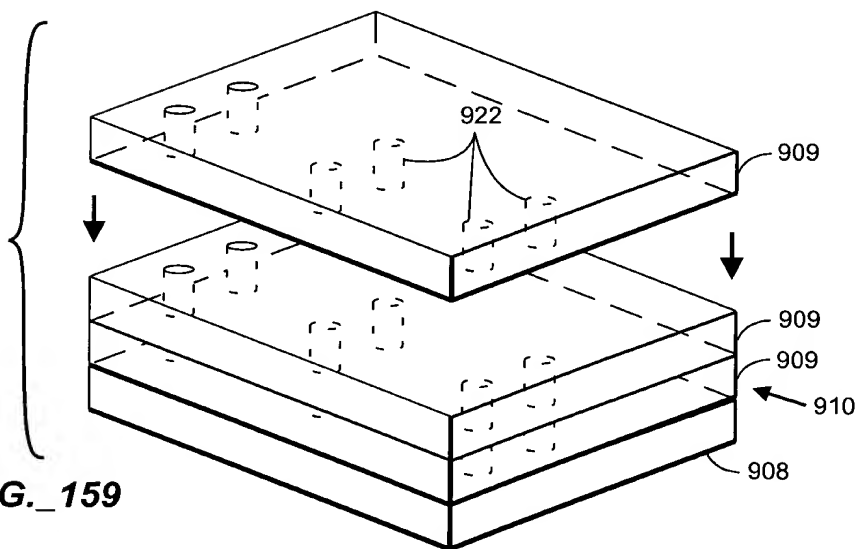
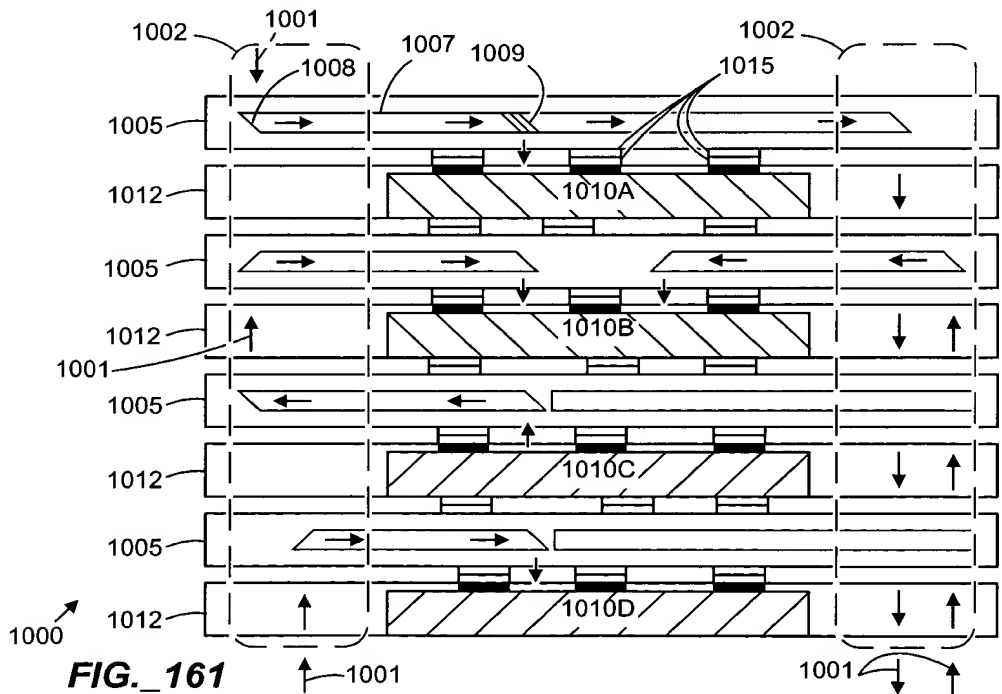
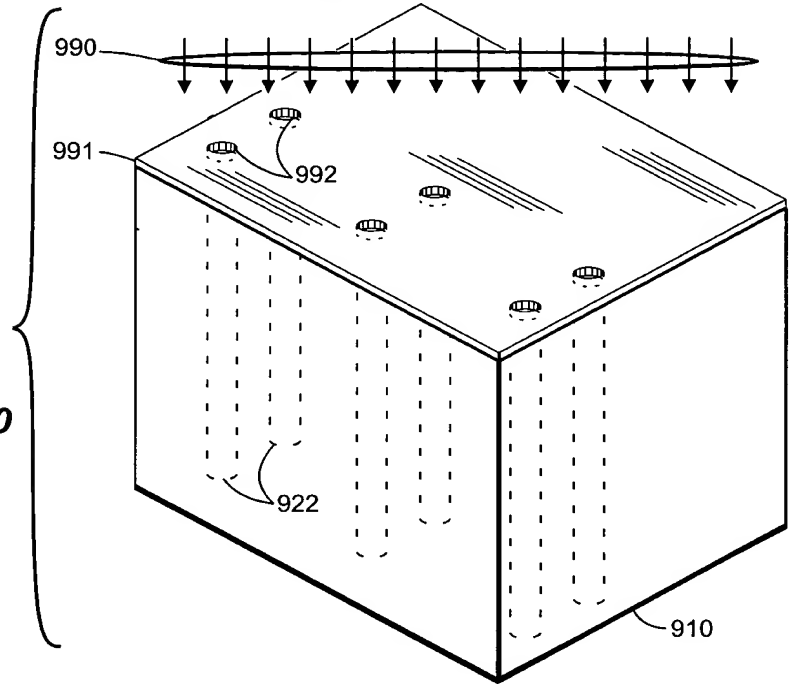


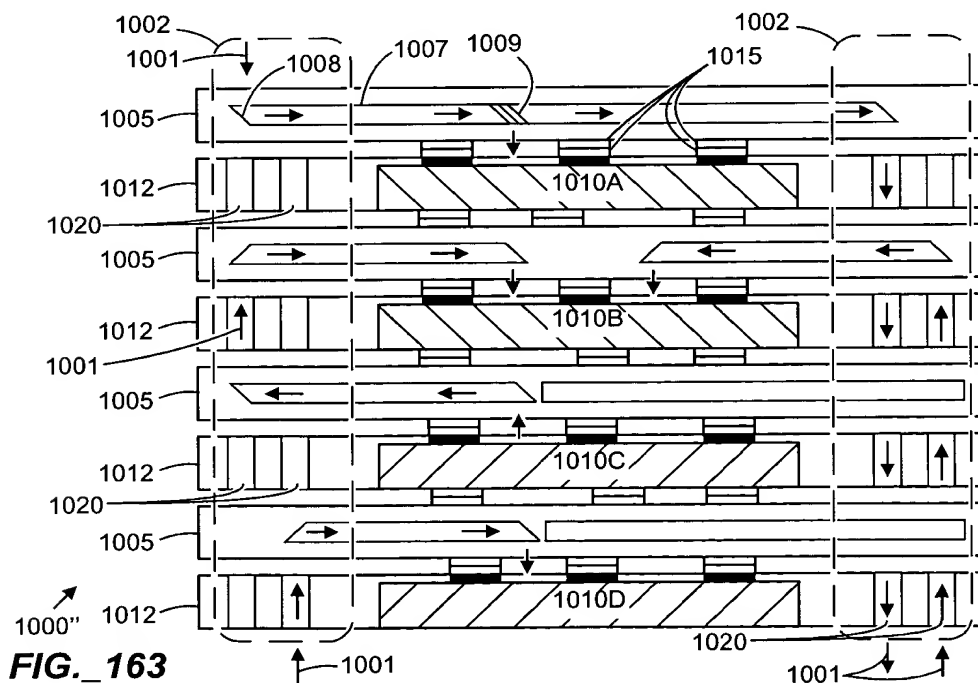
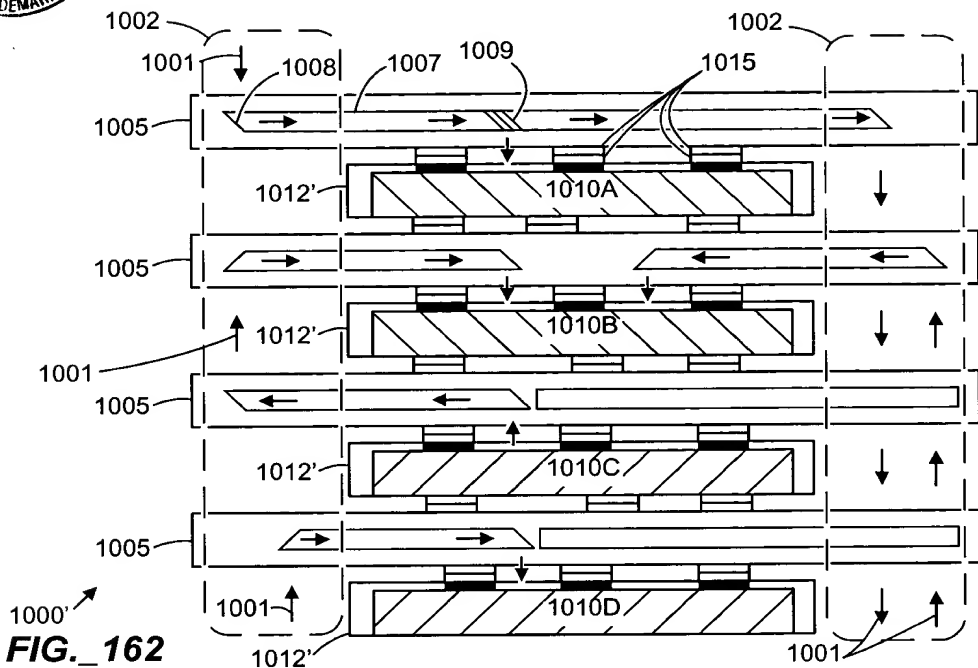
FIG. 159



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FIG. 160







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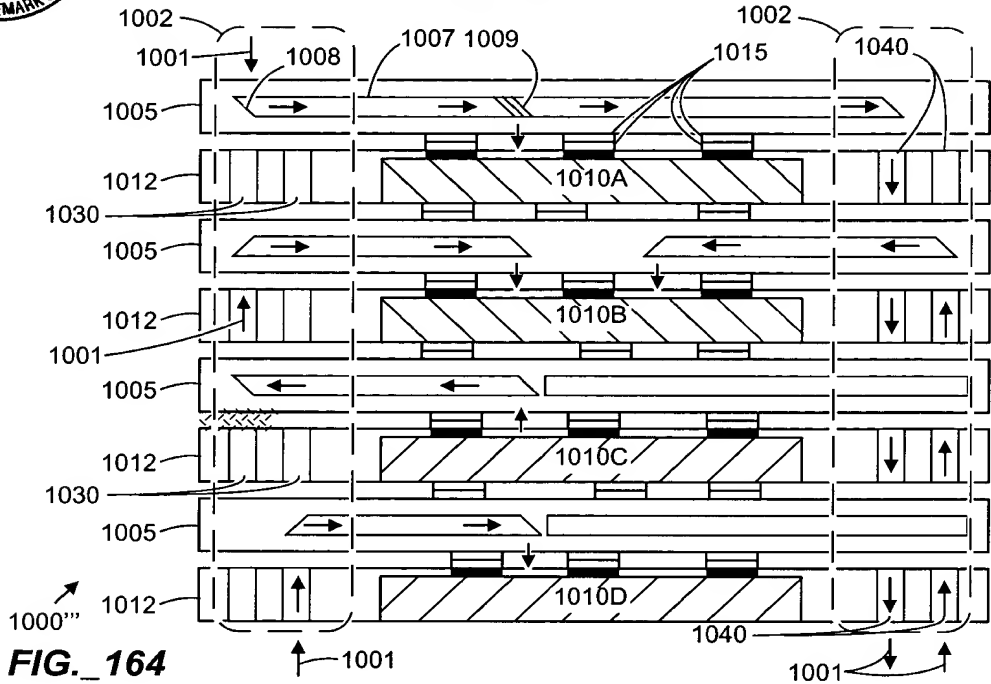


FIG. 164

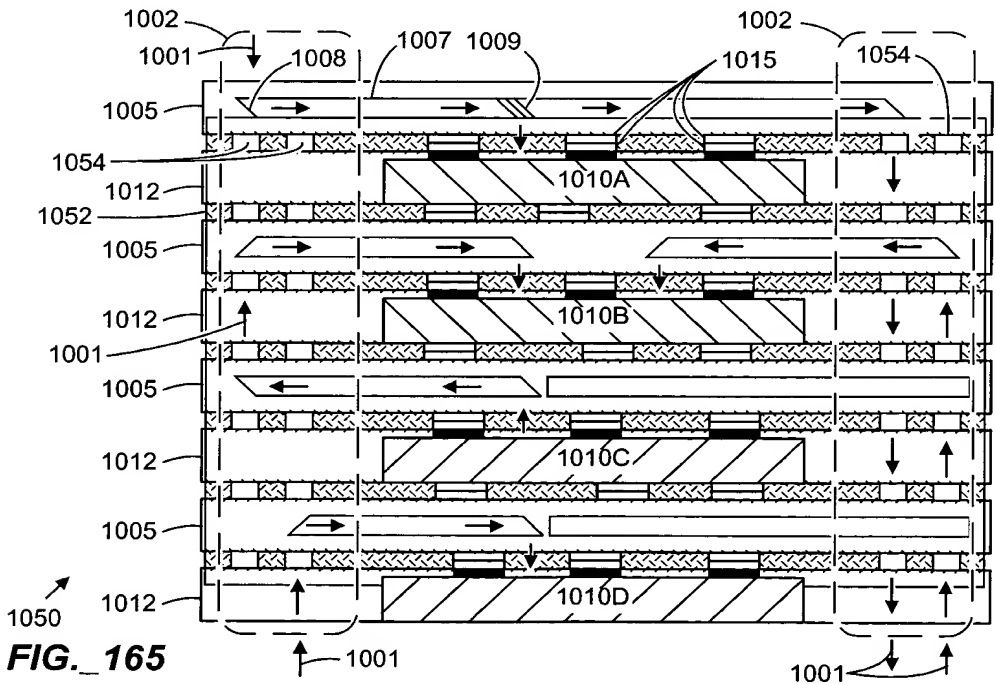
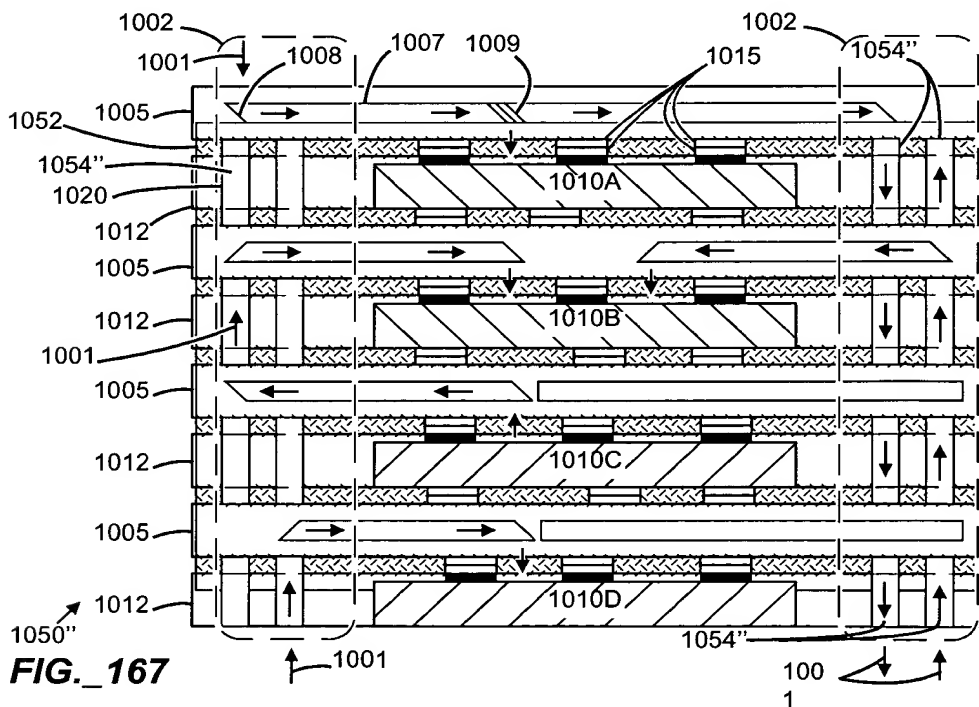
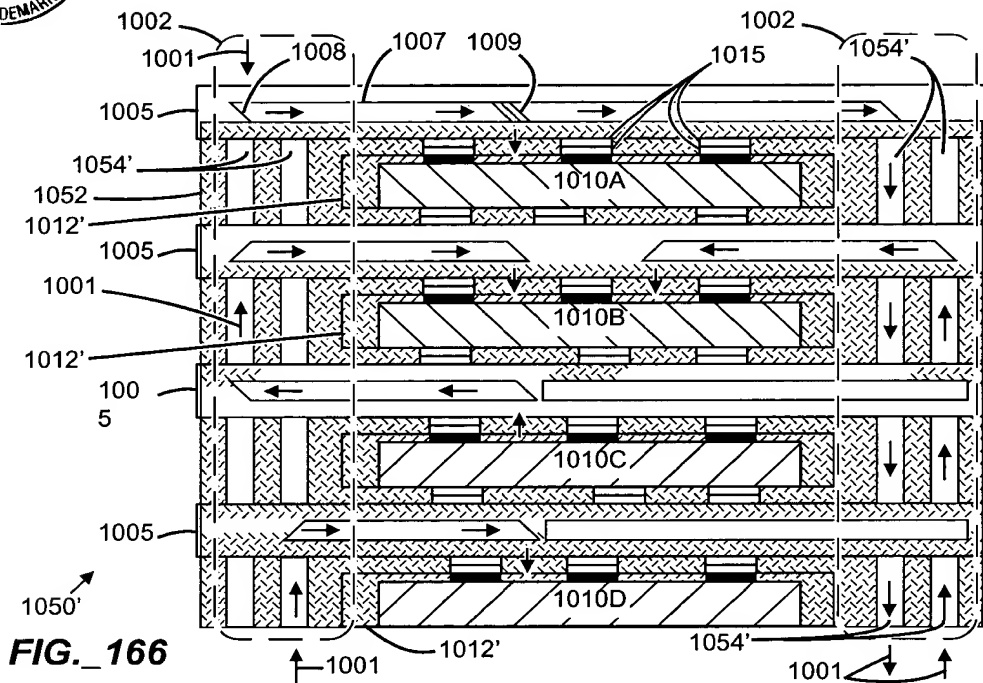


FIG. 165





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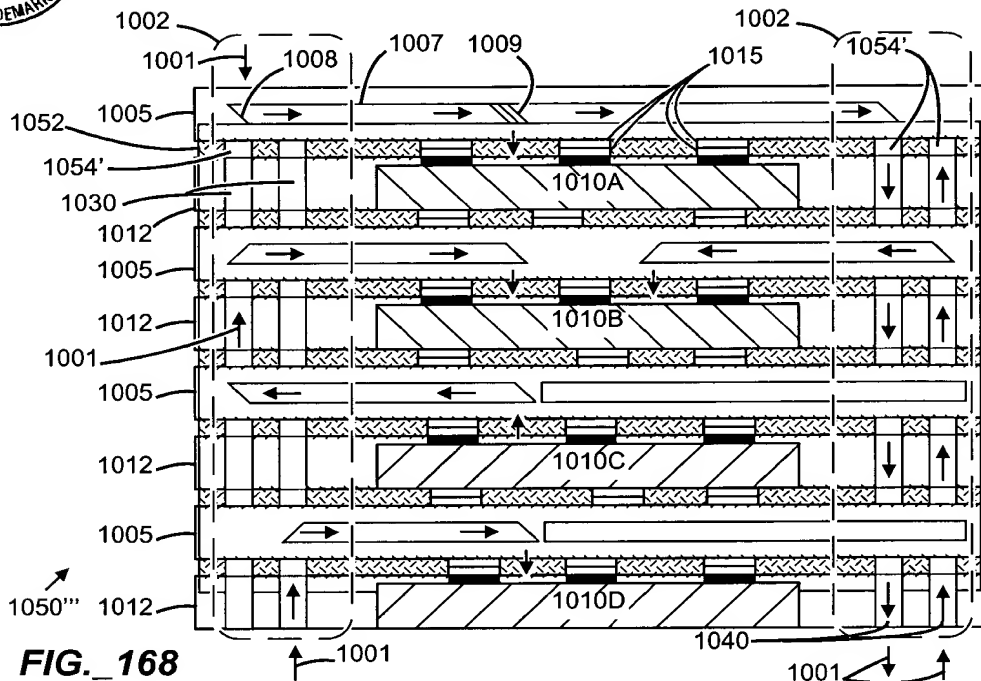


FIG. 168

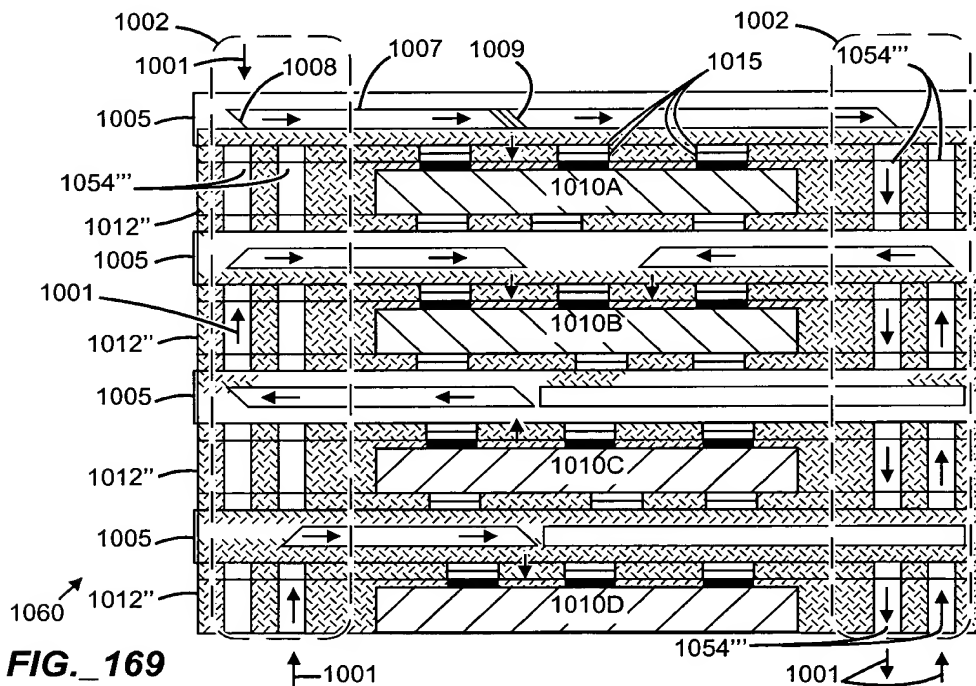


FIG. 169



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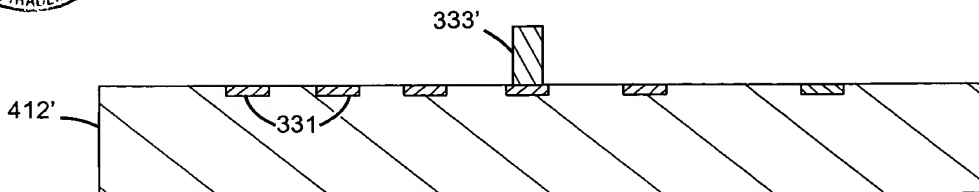


FIG. 170

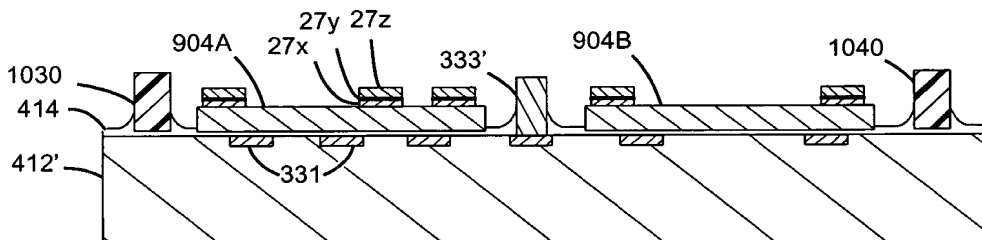


FIG. 171

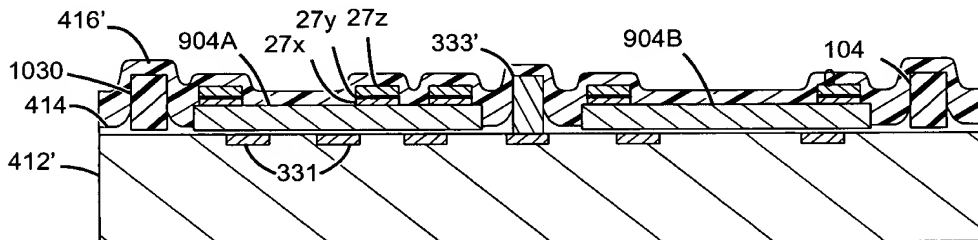


FIG. 172

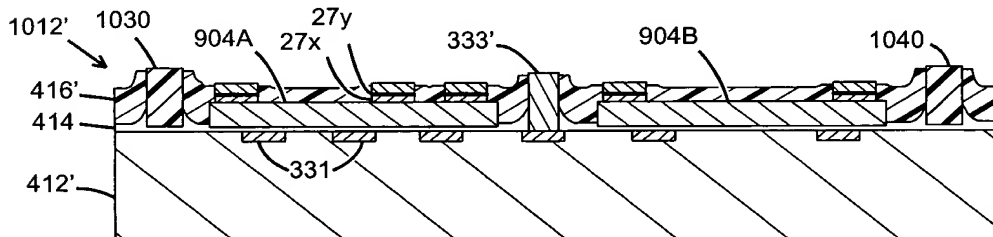


FIG. 173

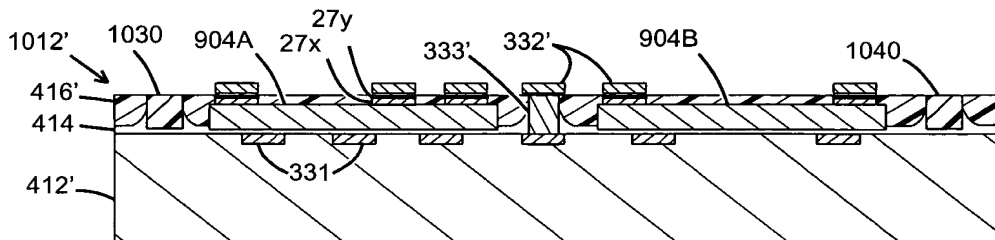


FIG. 174

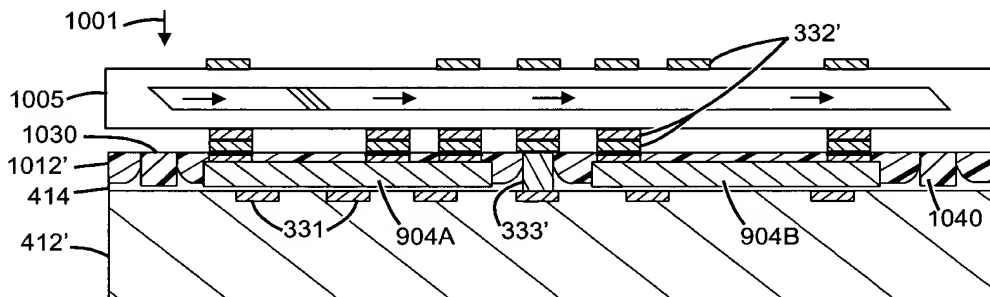


FIG. 175

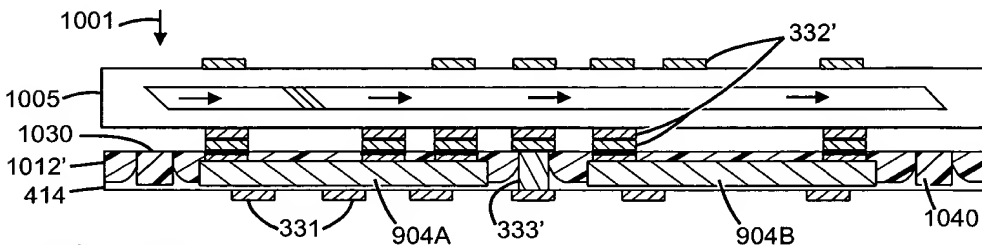


FIG. 176



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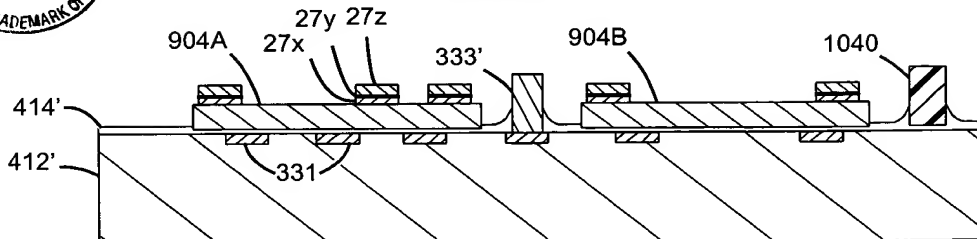


FIG. 177

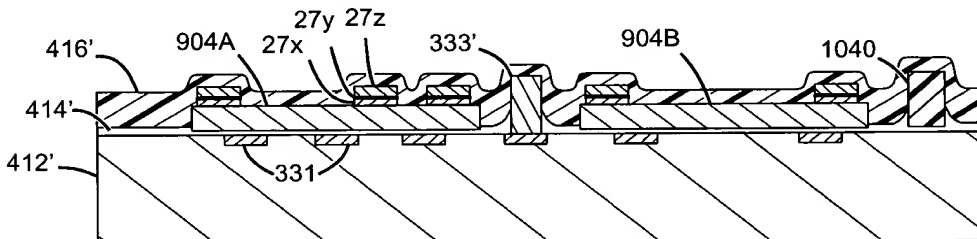


FIG. 178

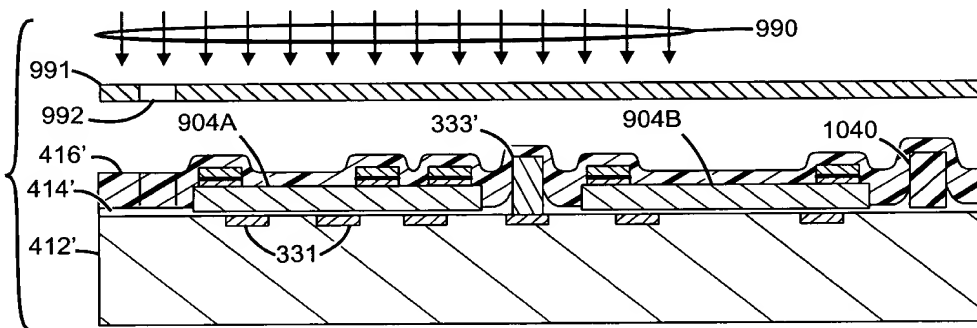


FIG. 179

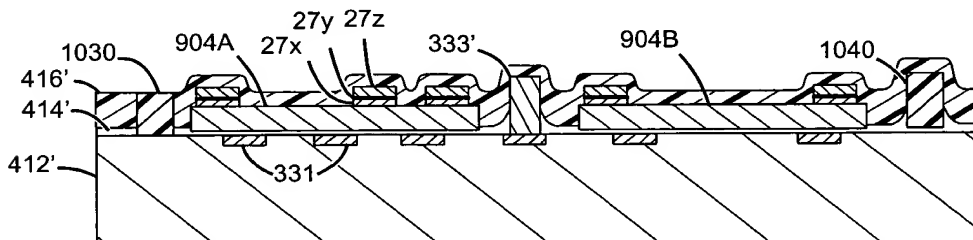
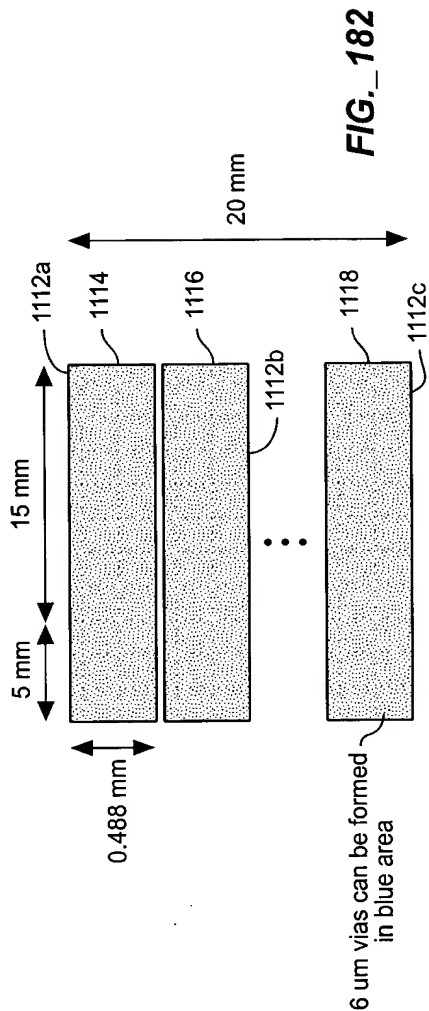
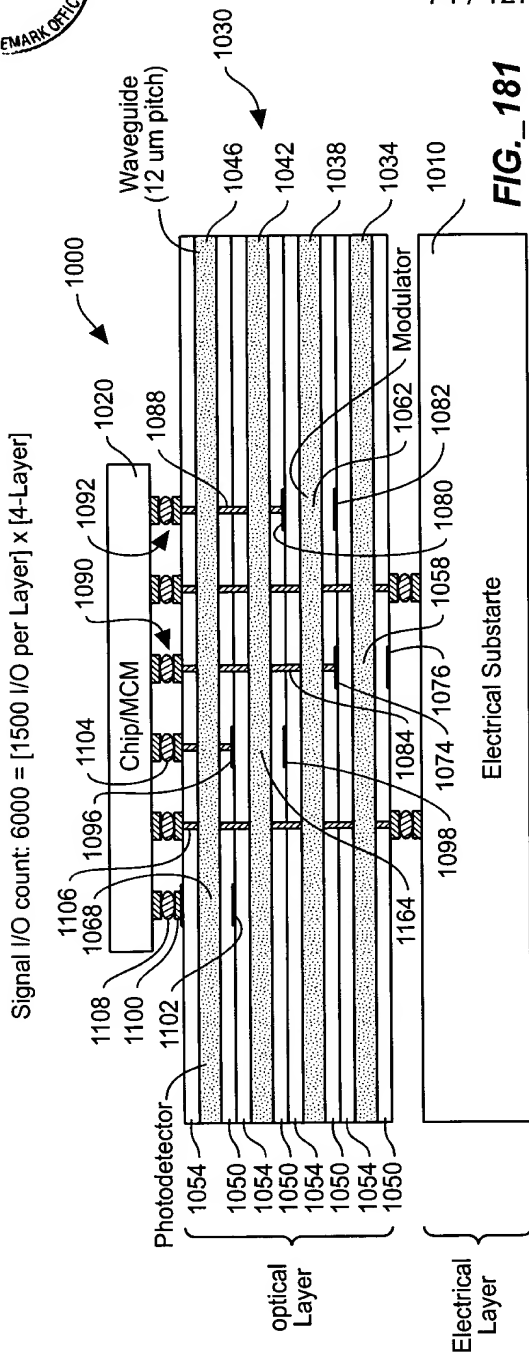
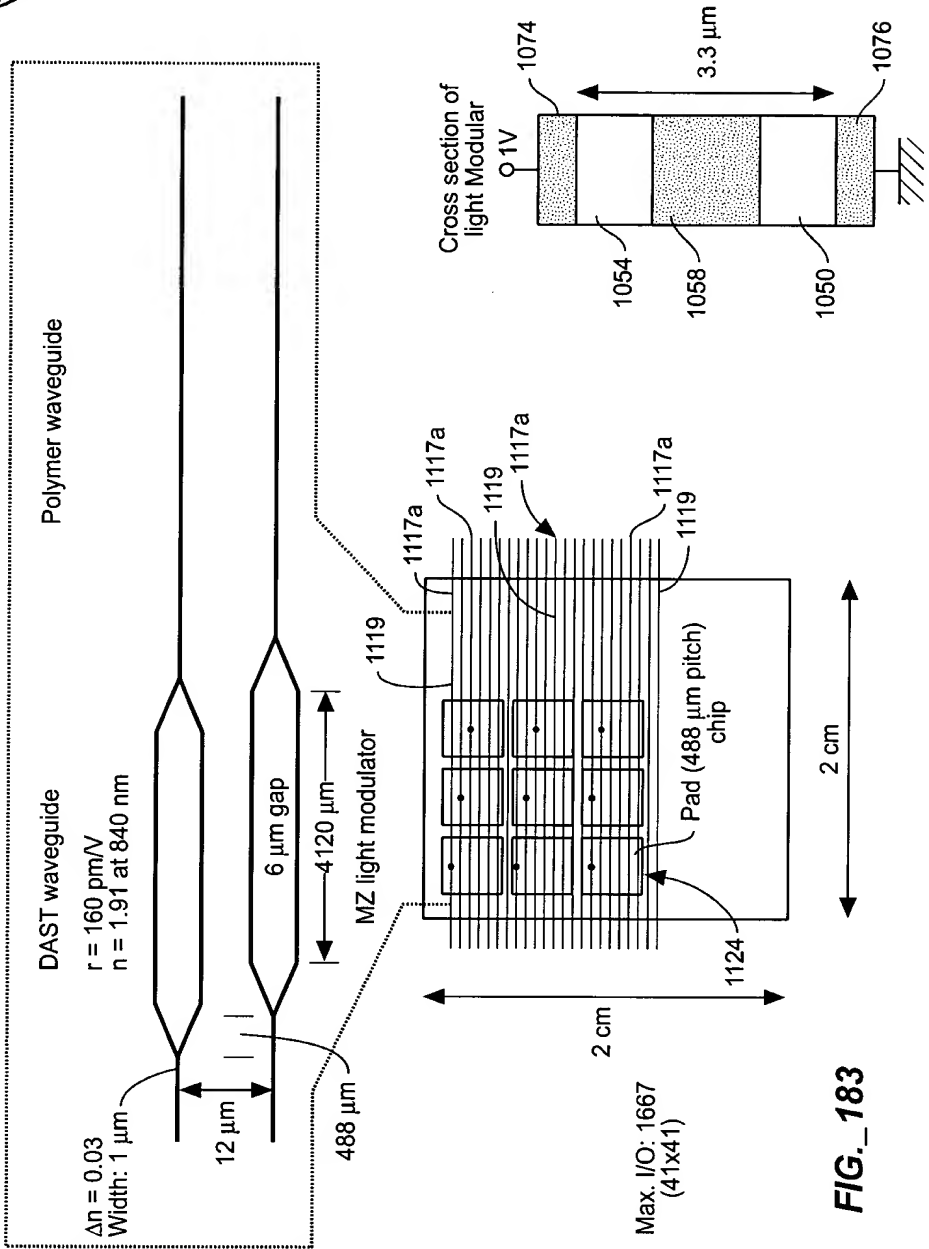


FIG. 180







Signal I/O count: 6000 = [1500 I/O per Layer] x [4-Layer]

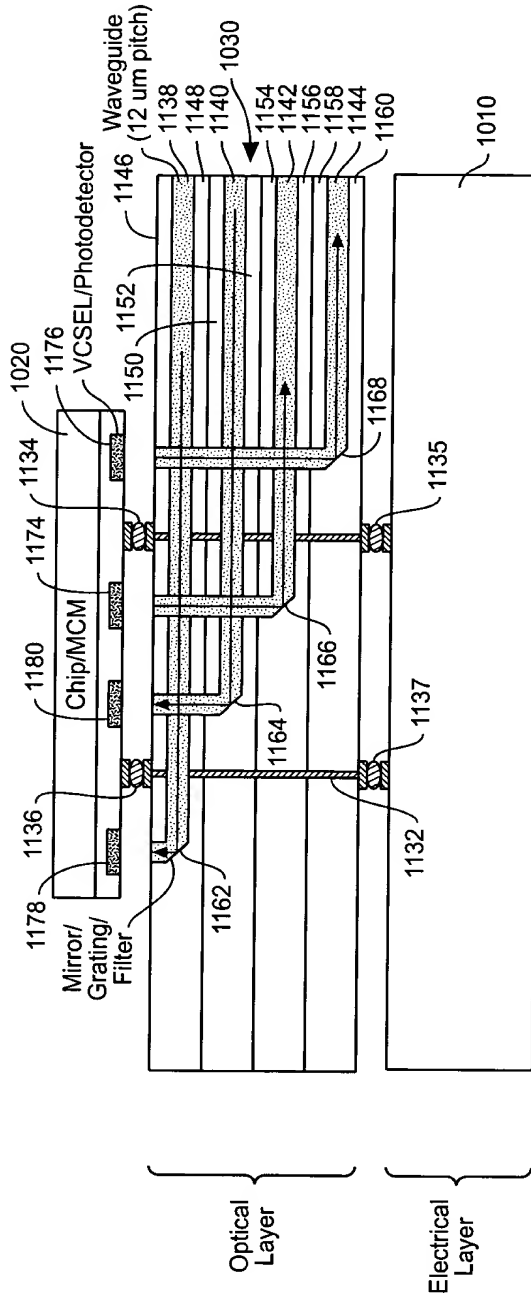


FIG. 185



Signal I/O count: 6000 = [1500 I/O per Layer] x [4-Layer]

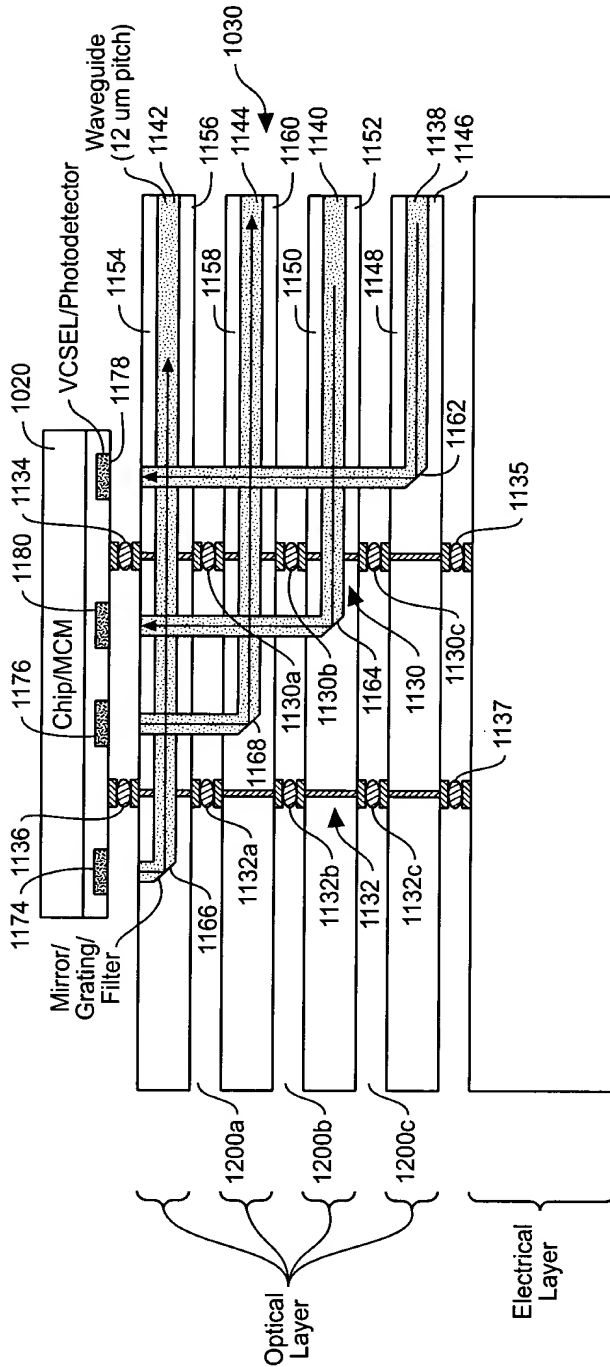


FIG. 186



Signal I/O count: 6000 = [1500 I/O per Layer] x [4-Layer]

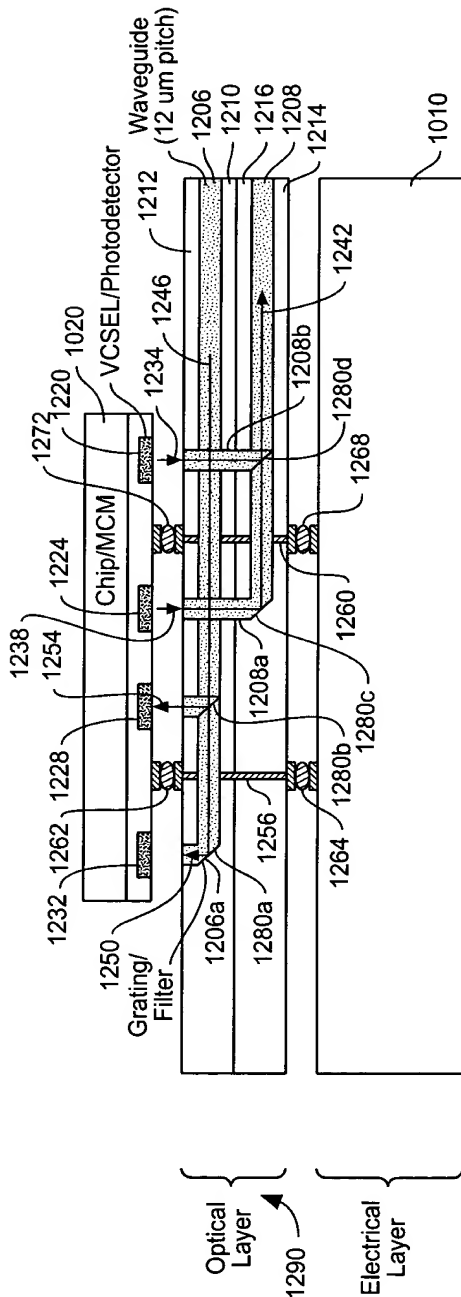


FIG. 187



Signal I/O count: 6000 = [1500 I/O per Layer] x [4-Layer]

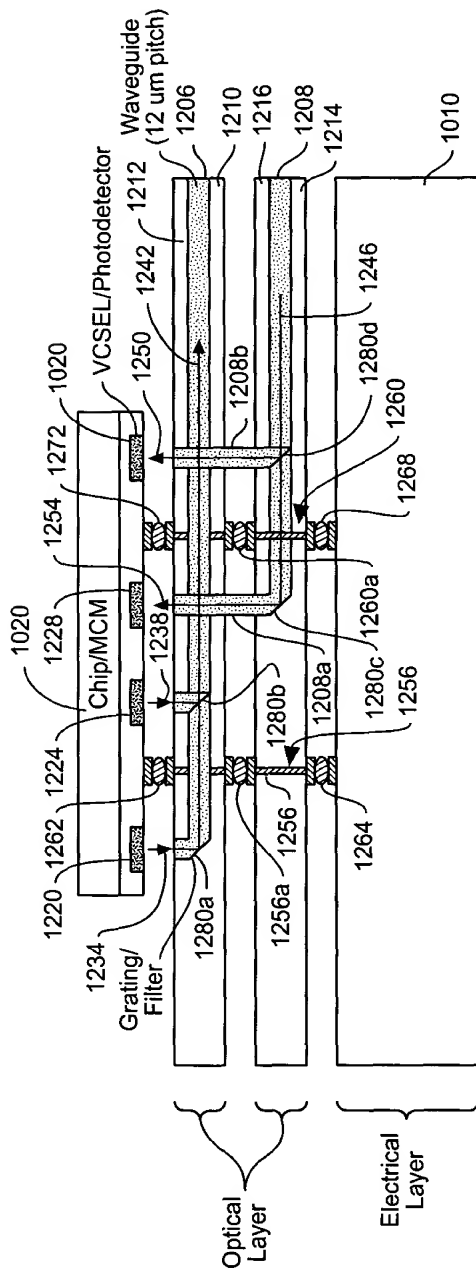


FIG. 188

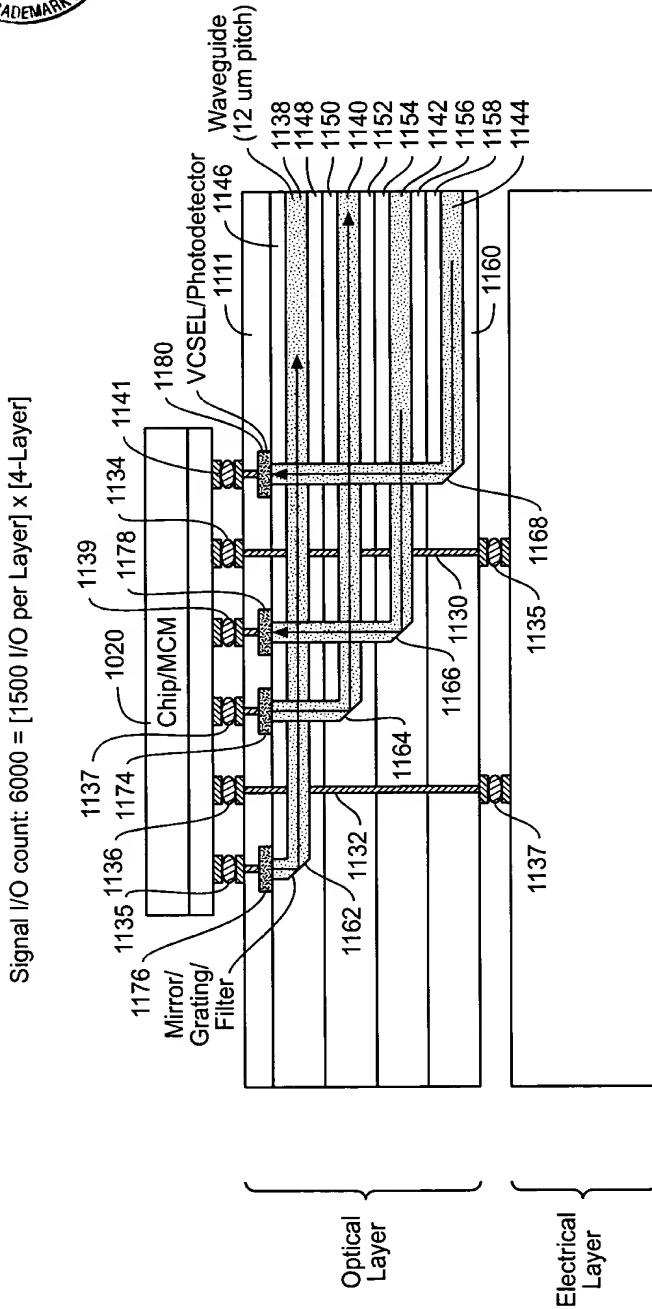


FIG. 189



Signal I/O count: 6000 = [1500 I/O per Layer] x [4-Layer]

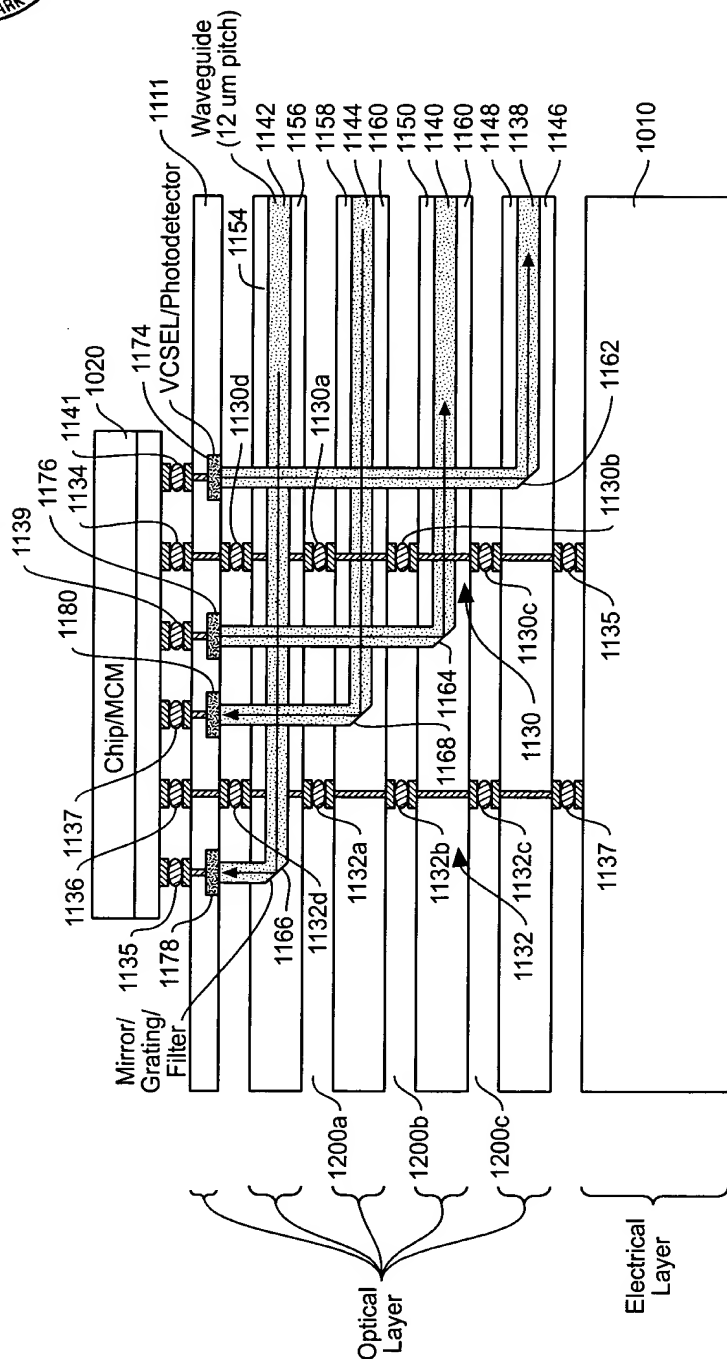


FIG. 190



Signal I/O count: 6000 = [1500 I/O per Layer] x [4-Layer]

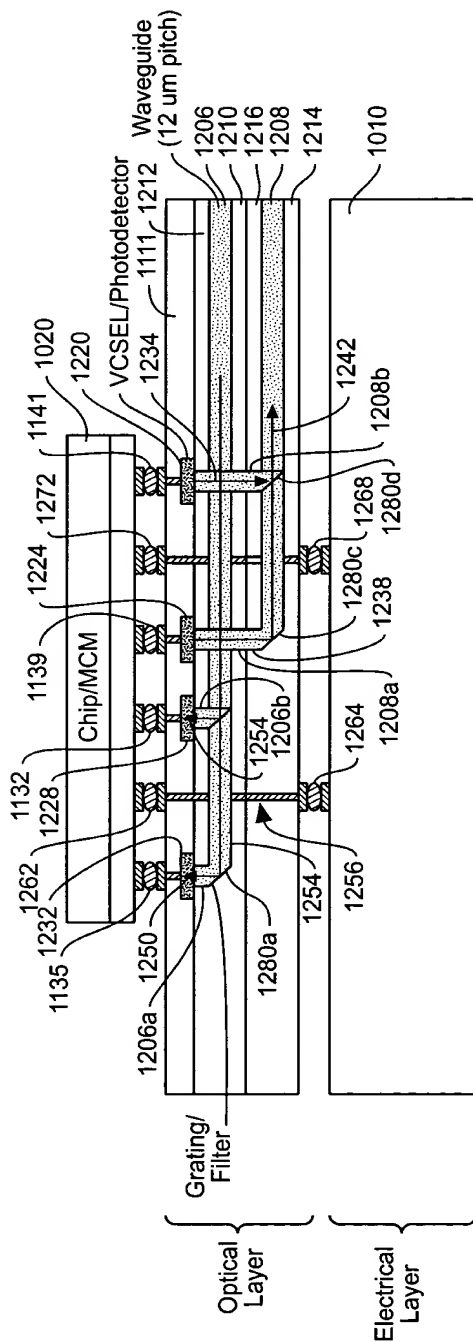


FIG. 191A



Signal I/O count: 6000 = [1500 I/O per Layer] x [4-Layer]

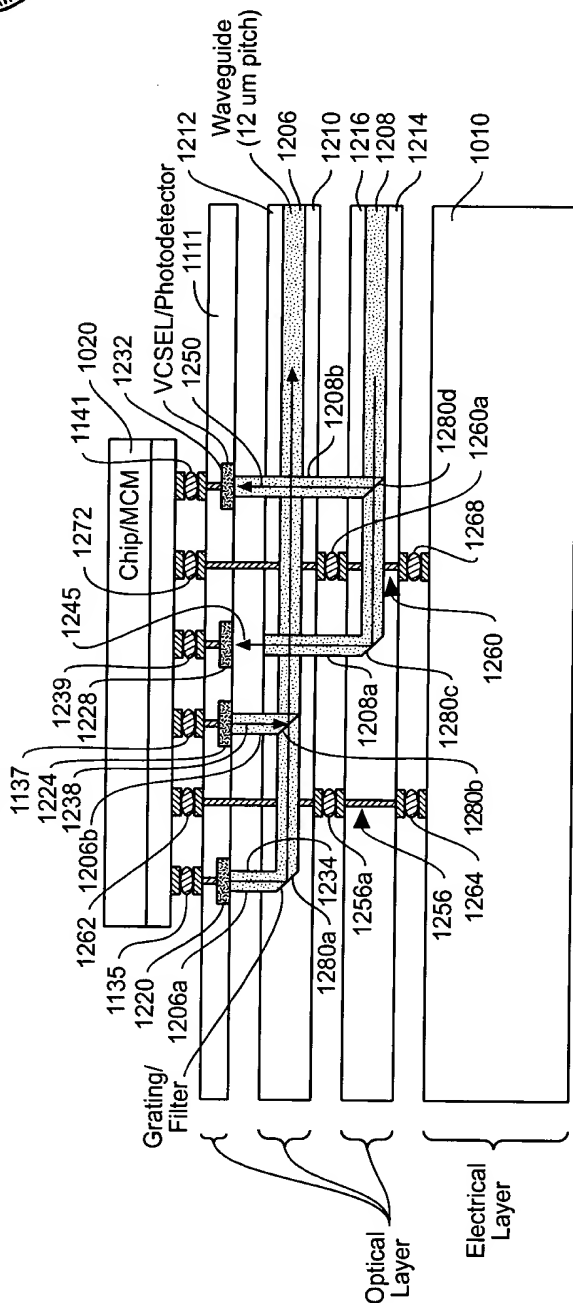


FIG._191B

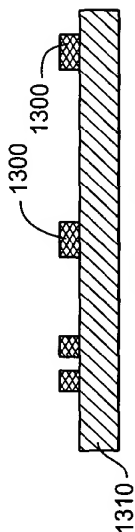


FIG. 193

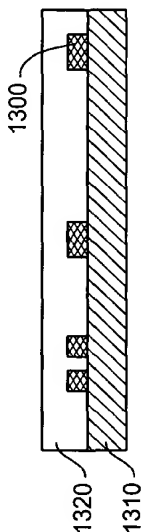


FIG. 195

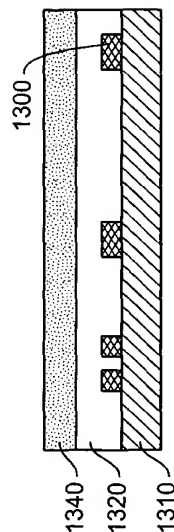


FIG. 197

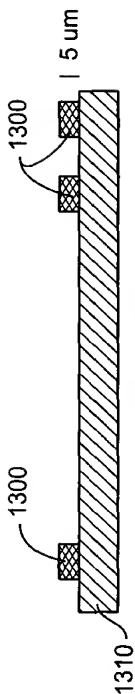


FIG. 192

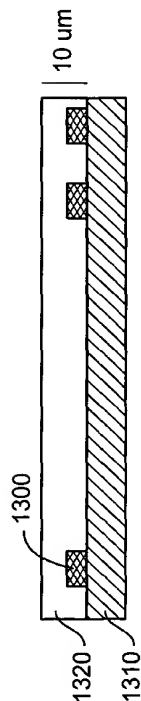


FIG. 194

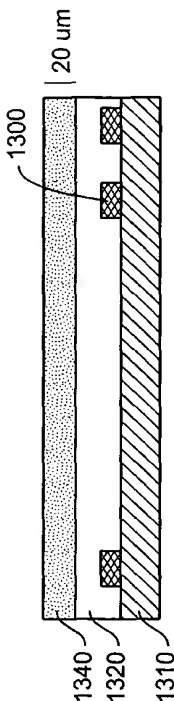


FIG. 196

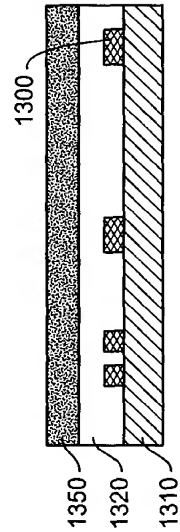


FIG. 199

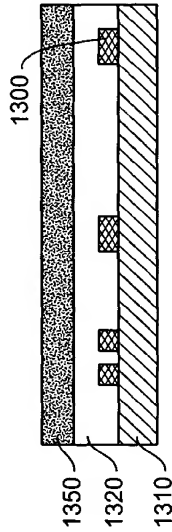


FIG. 201

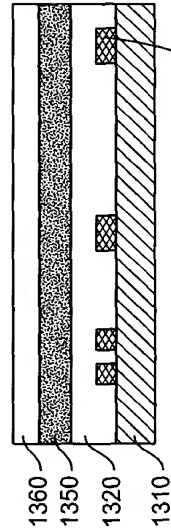


FIG. 203

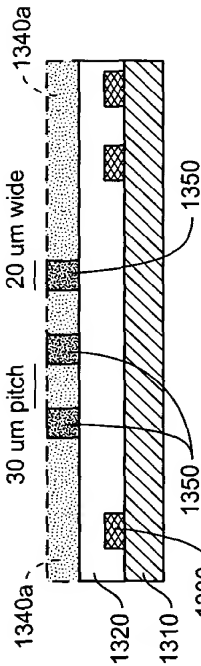


FIG. 198

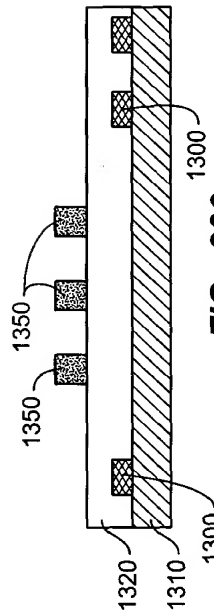


FIG. 200

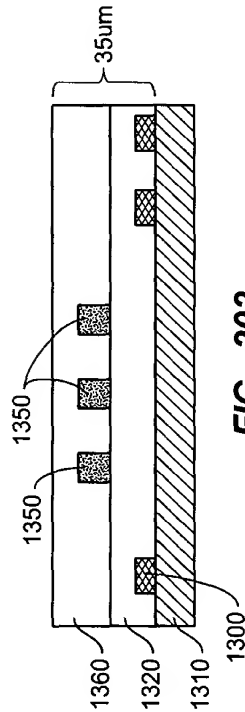


FIG. 202

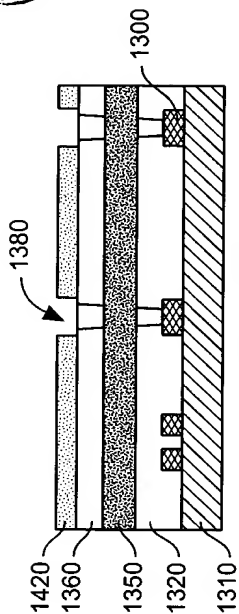


FIG. 205

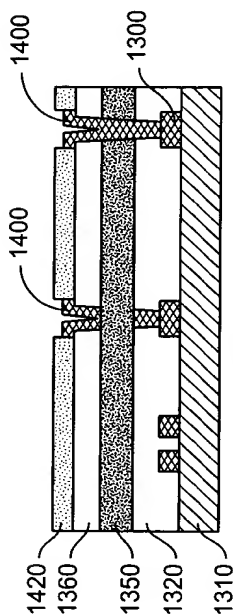


FIG. 207

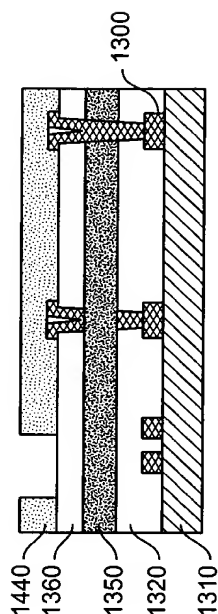


FIG. 209

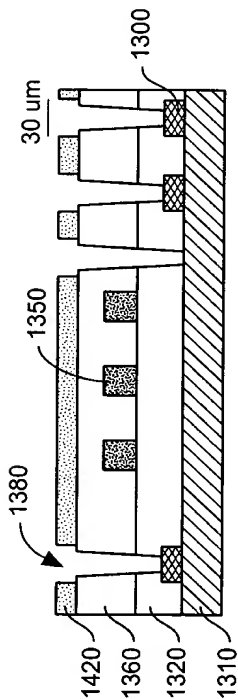


FIG. 204

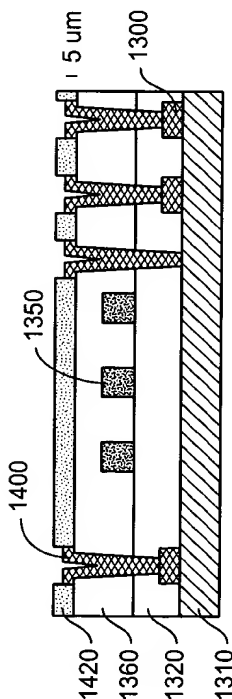


FIG. 206

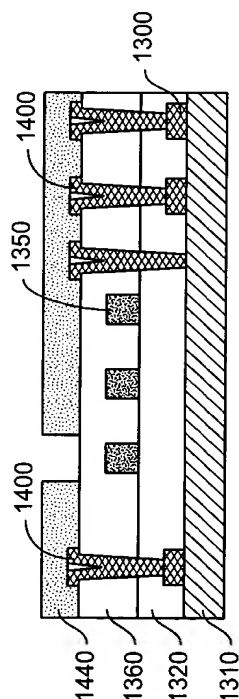
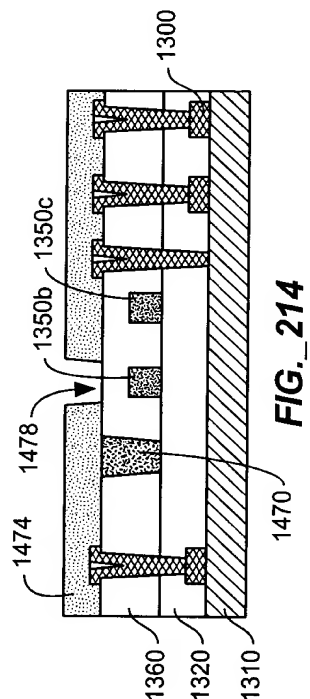
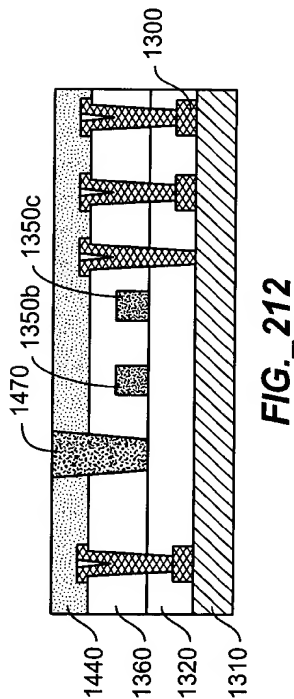
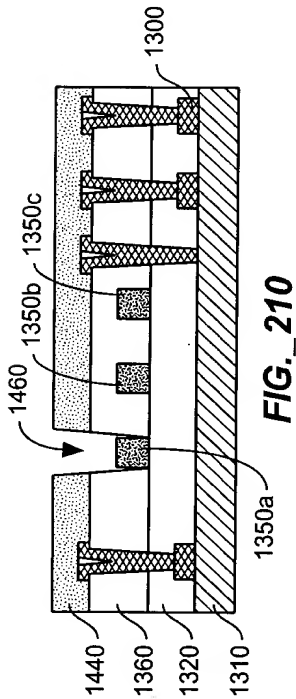
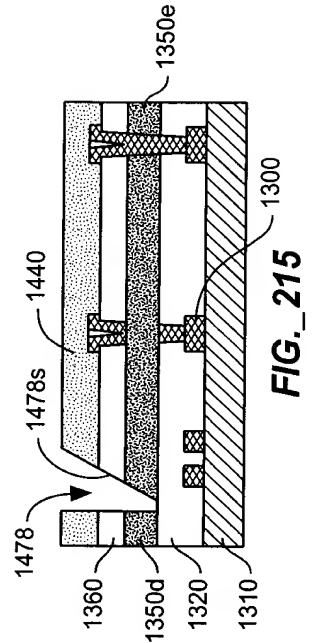
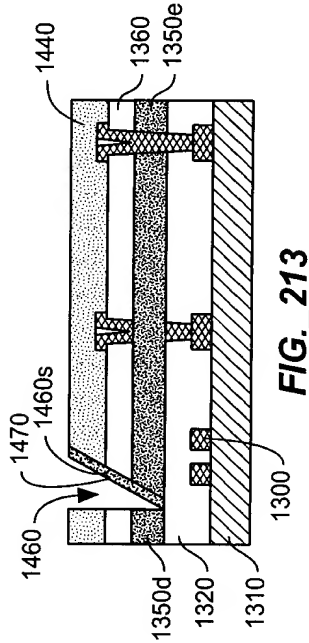
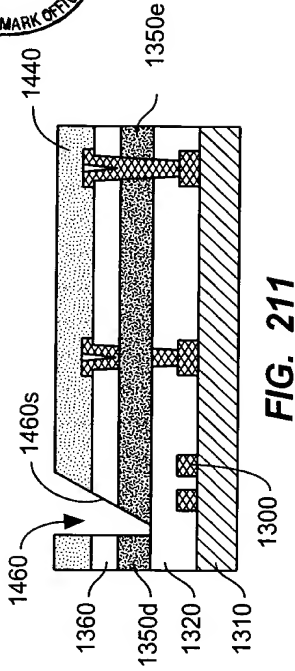
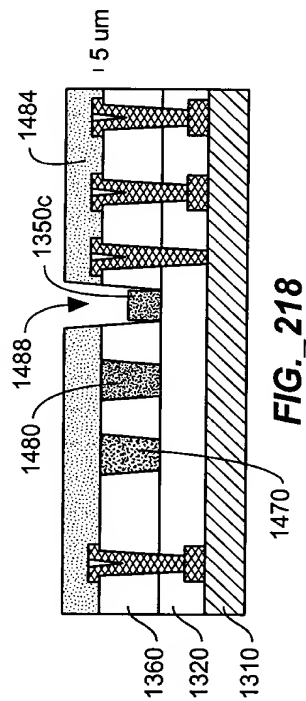
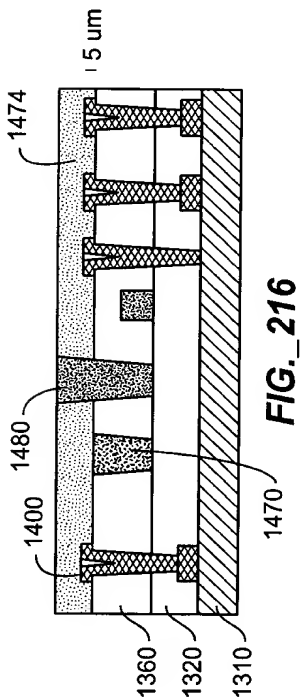
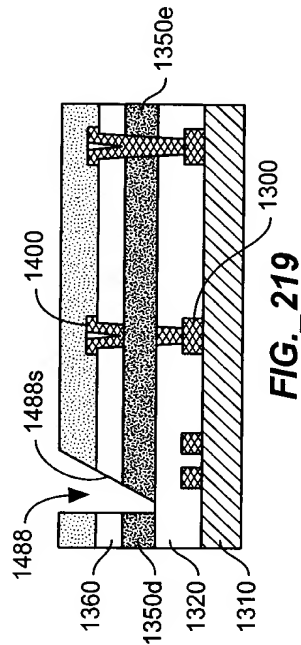
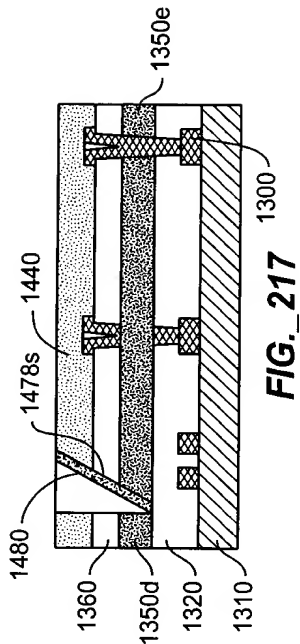


FIG. 208



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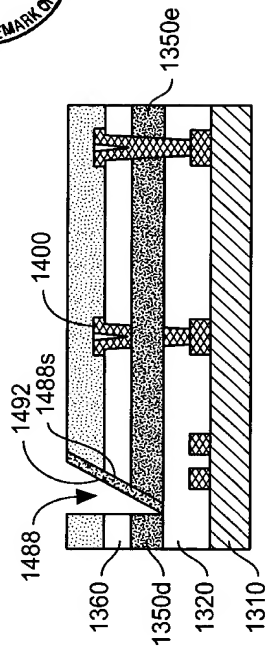


FIG. 221

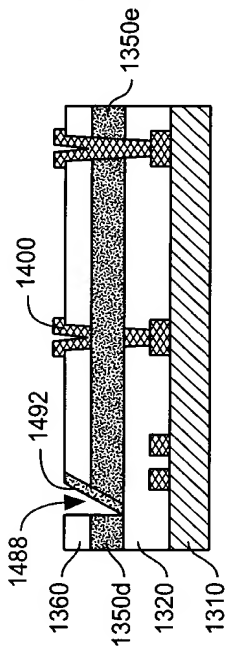


FIG. 223

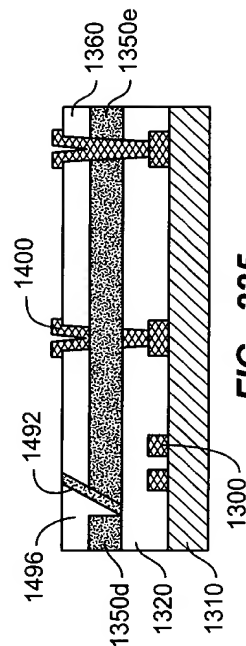


FIG. 225

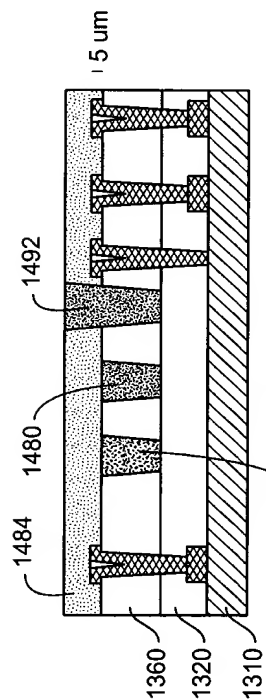


FIG. 220

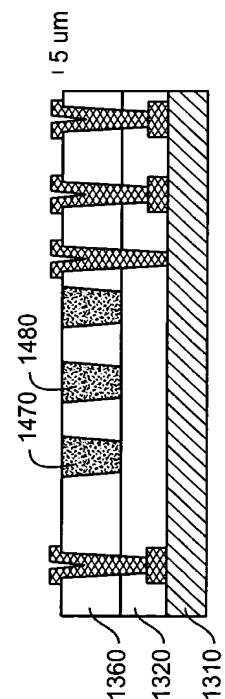


FIG. 222

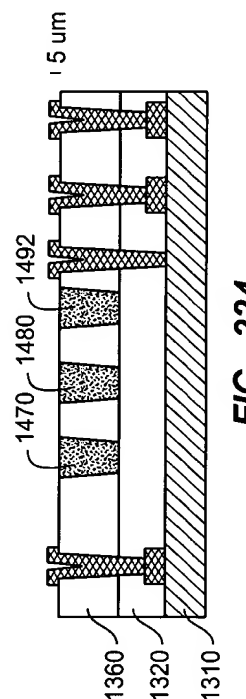
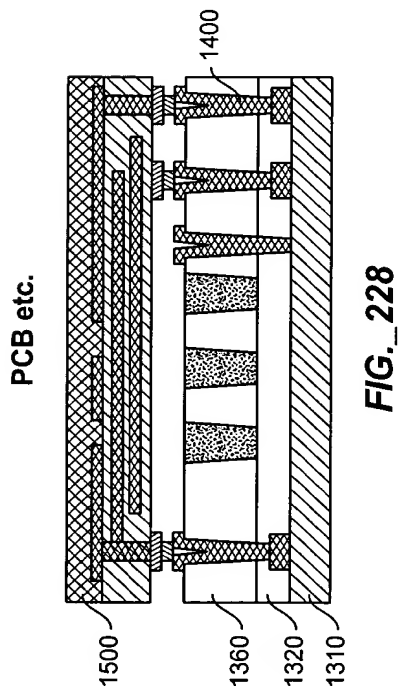
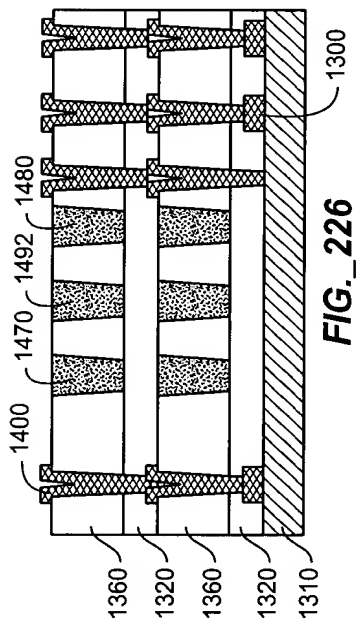
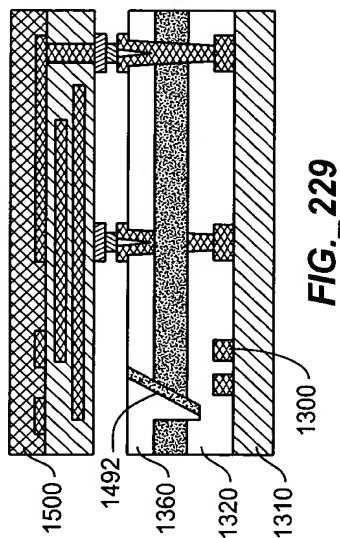
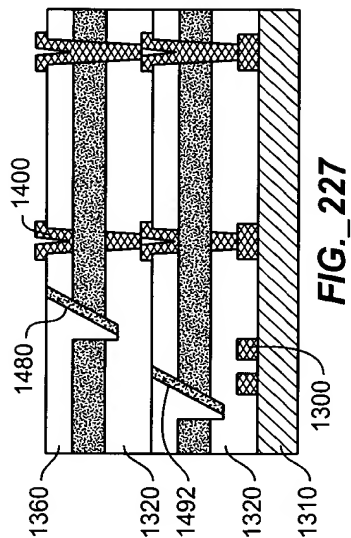
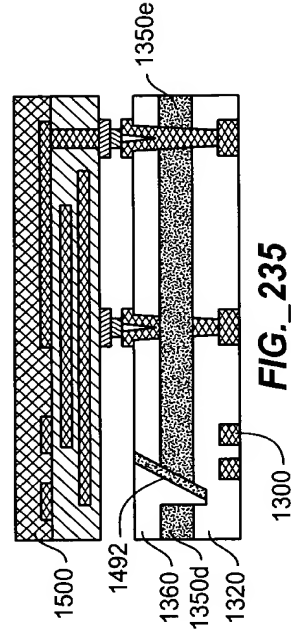
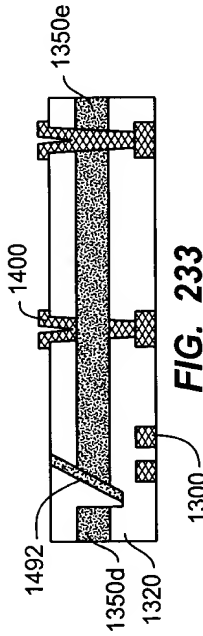
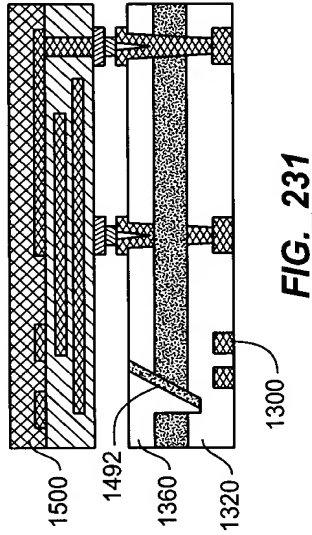
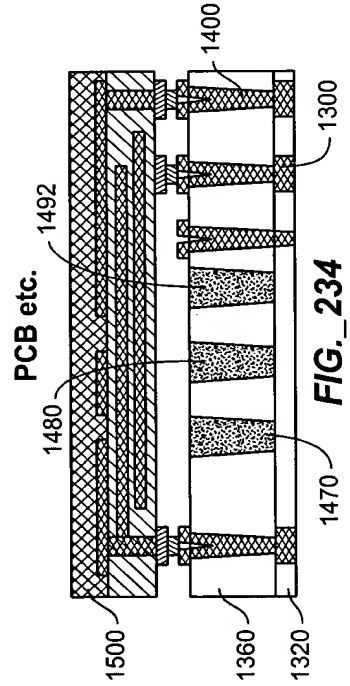
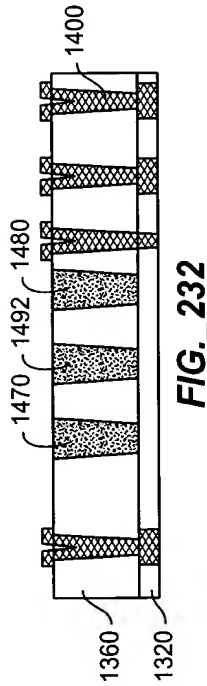
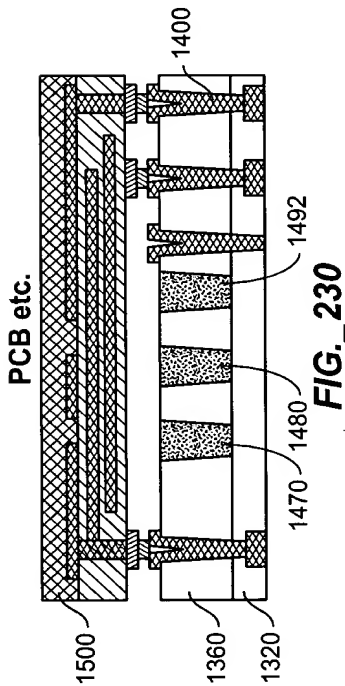


FIG. 224







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PCB etc.

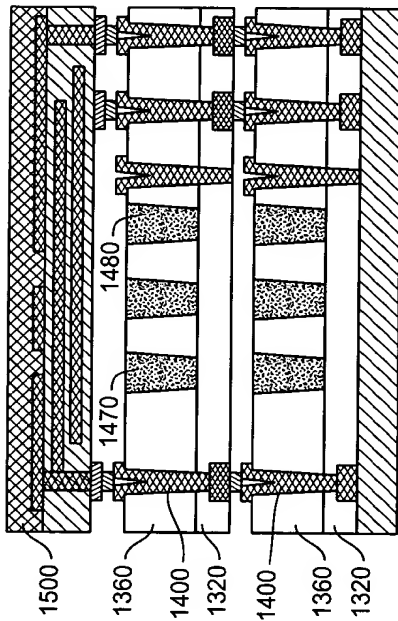


FIG. 236

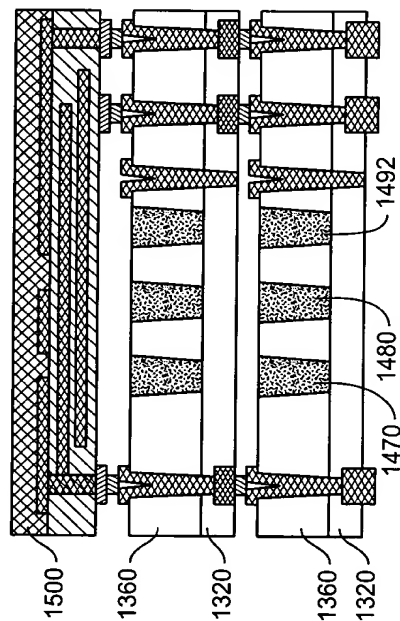


FIG. 238

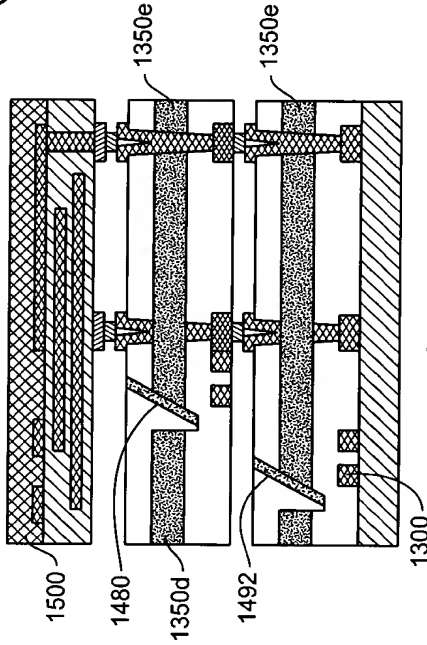


FIG. 237

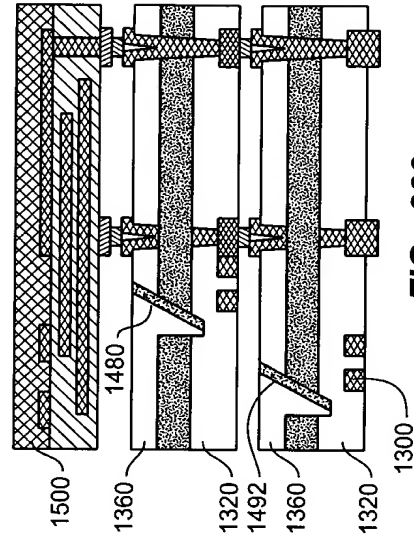


FIG. 239

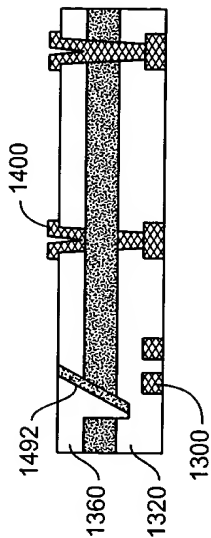


FIG. 241

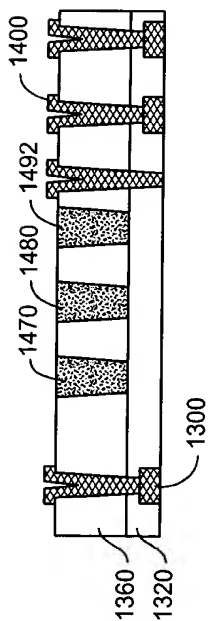


FIG. 240

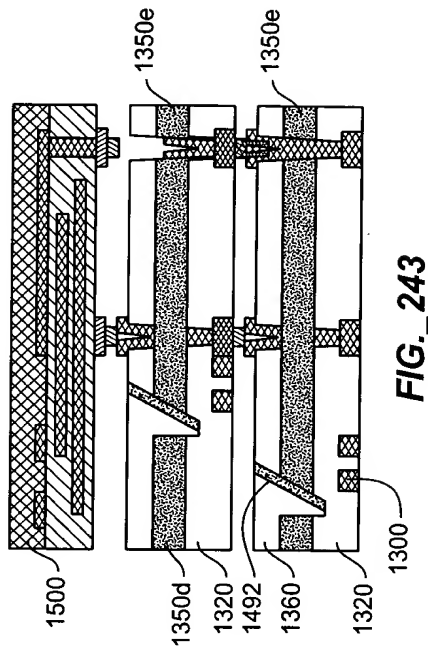


FIG. 243

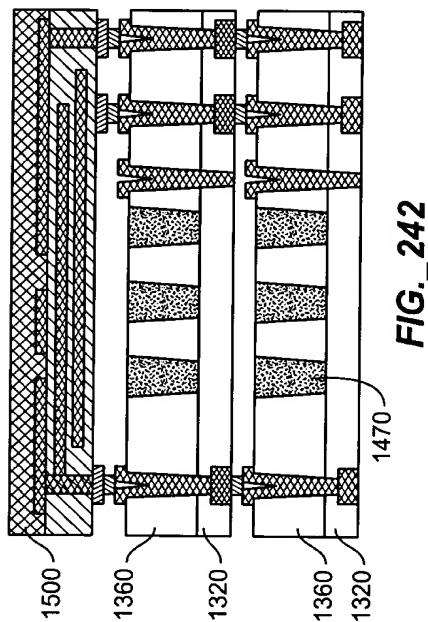


FIG. 242

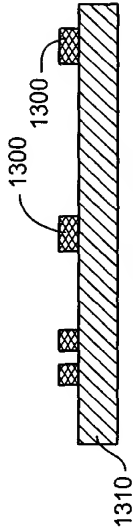


FIG. 245

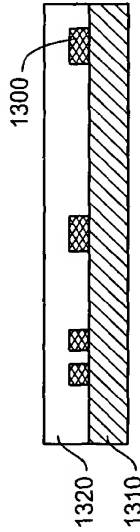


FIG. 247

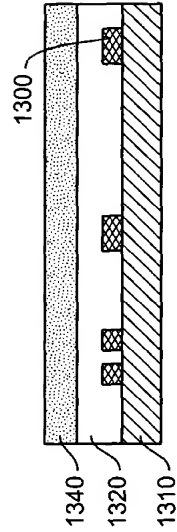


FIG. 249

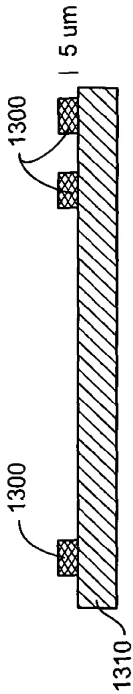


FIG. 244

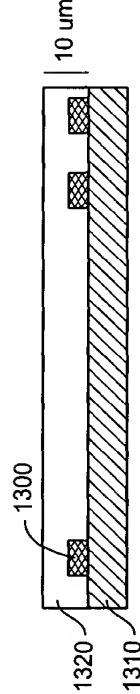


FIG. 246

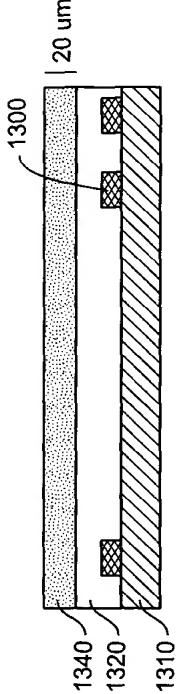


FIG. 248

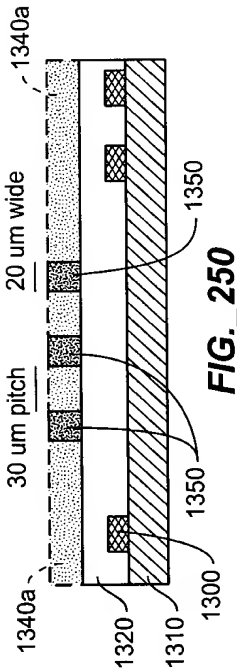


FIG. 251

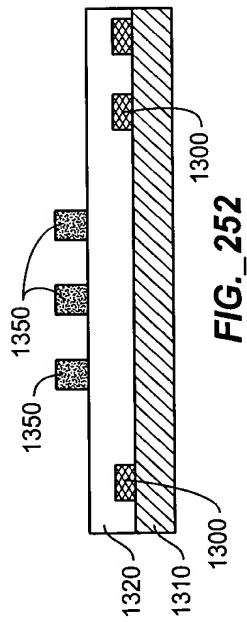


FIG. 253

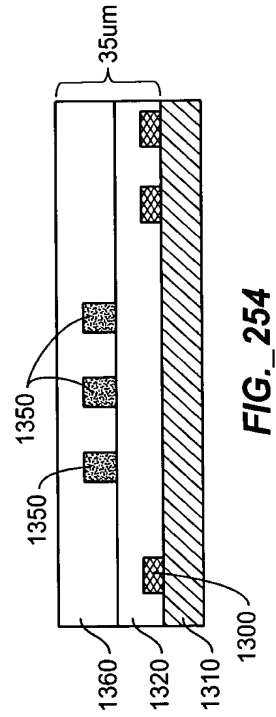
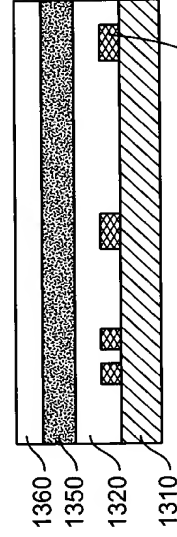
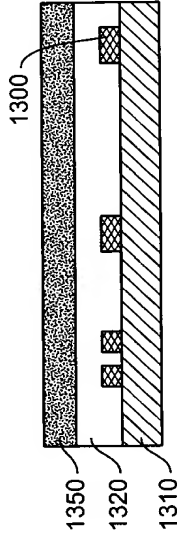
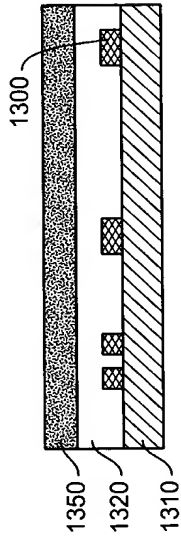
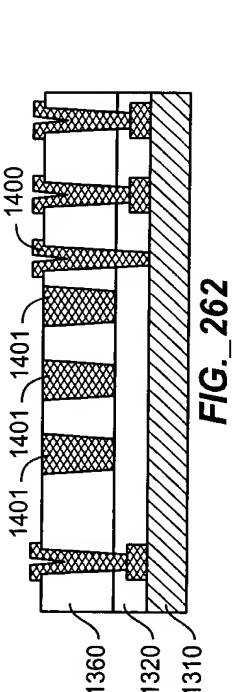
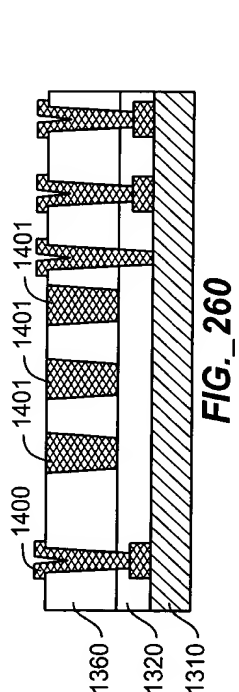
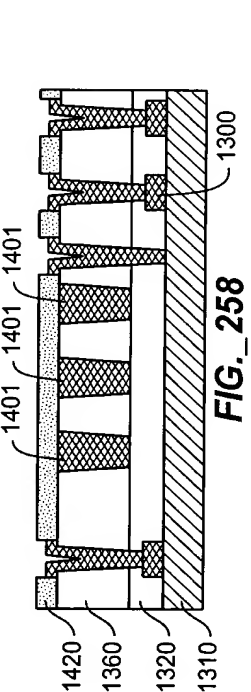
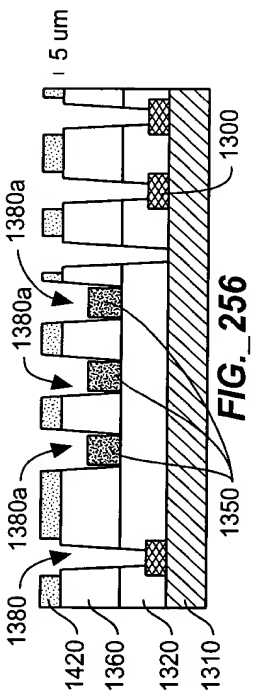
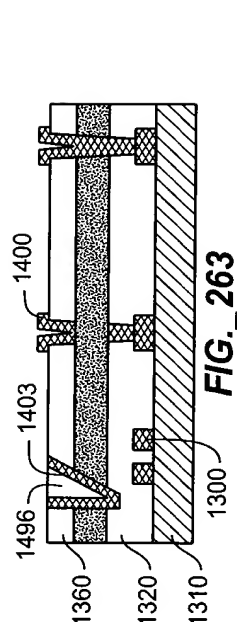
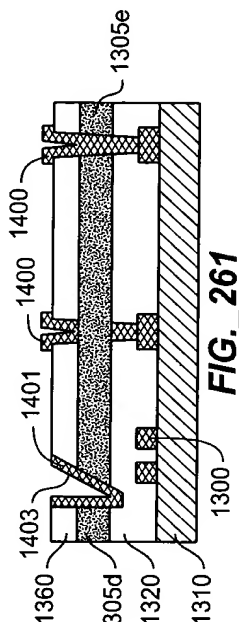
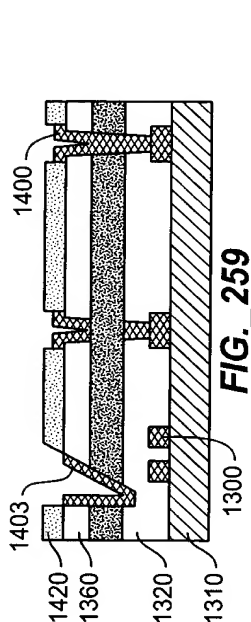
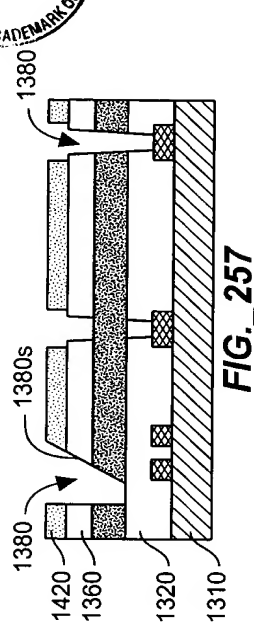
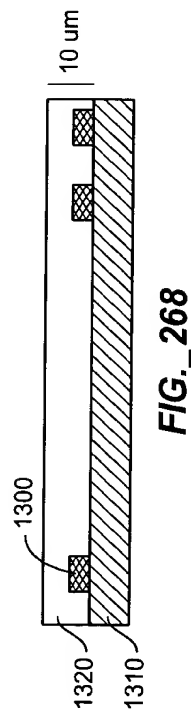
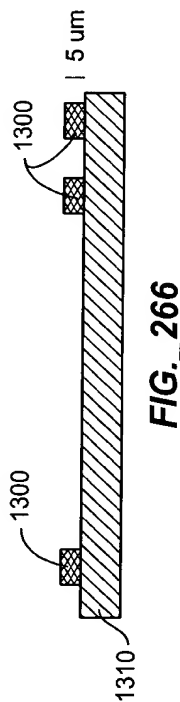
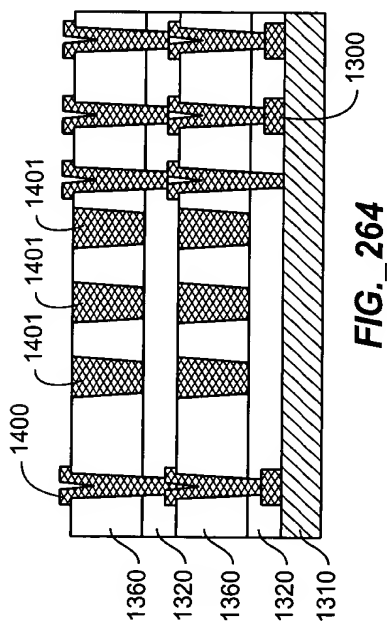
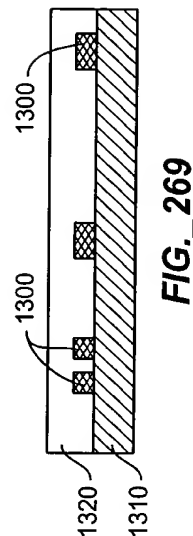
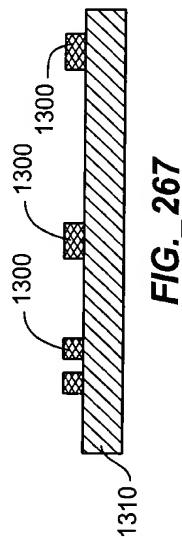
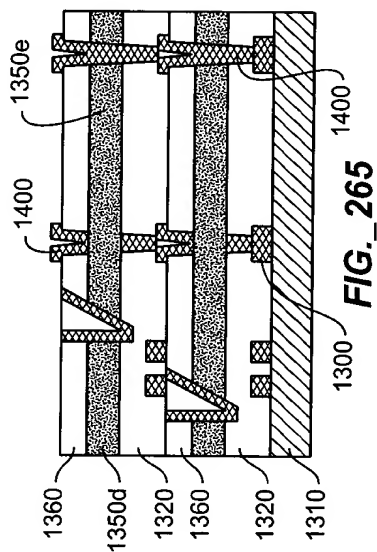
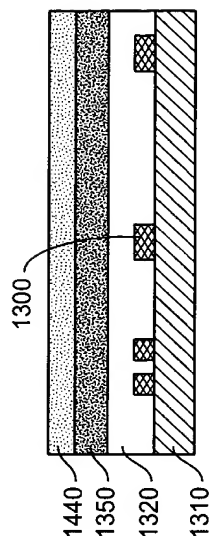
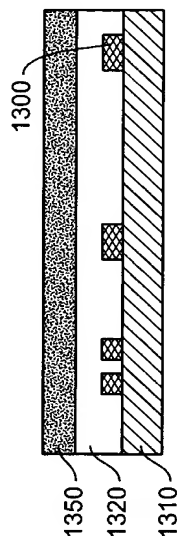
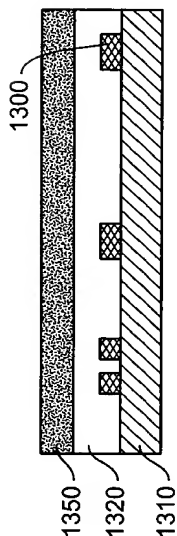
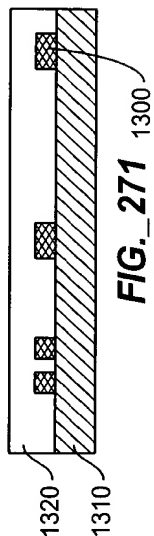
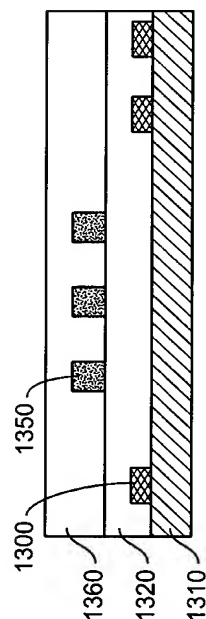
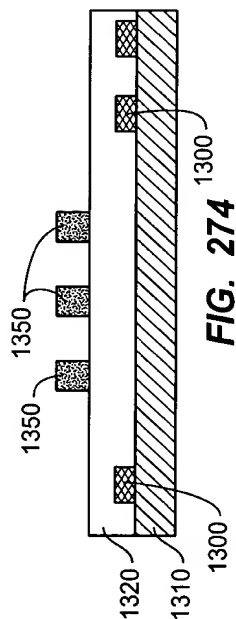
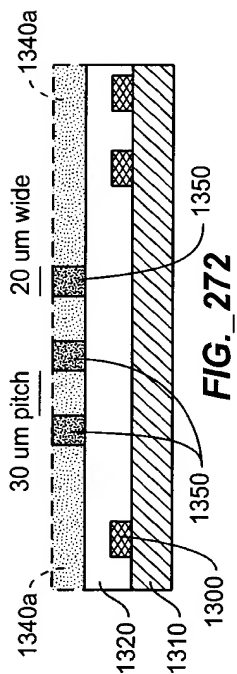
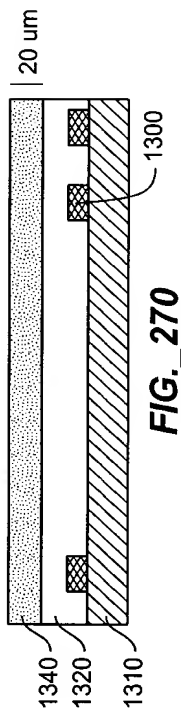


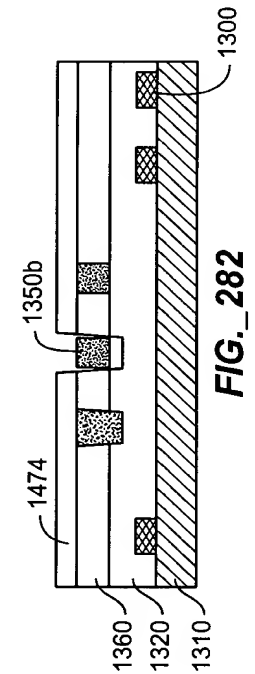
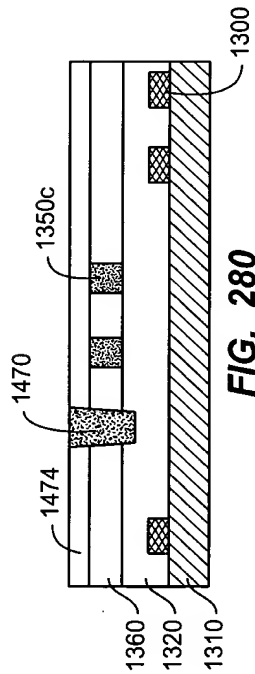
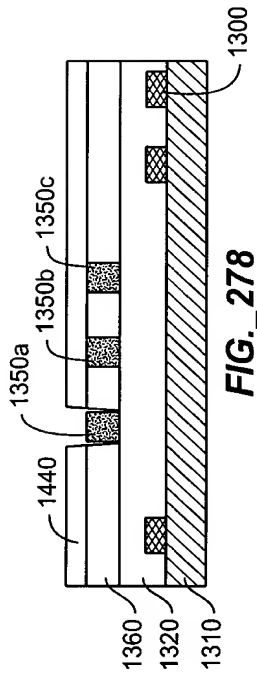
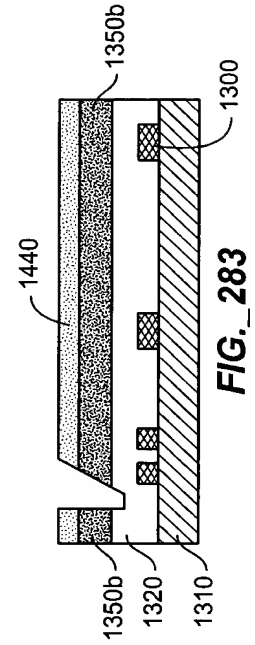
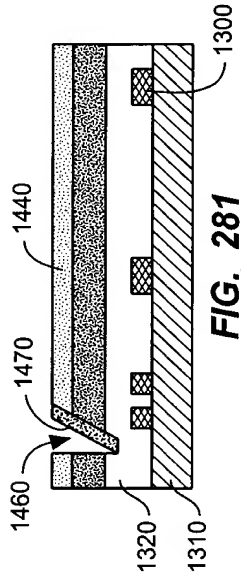
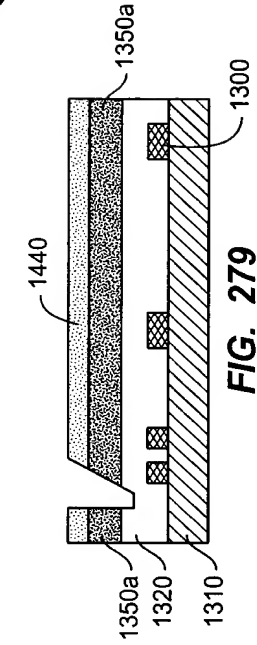
FIG. 255

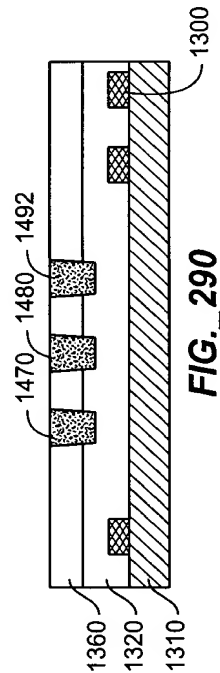
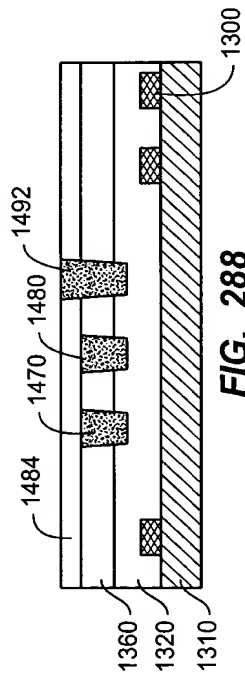
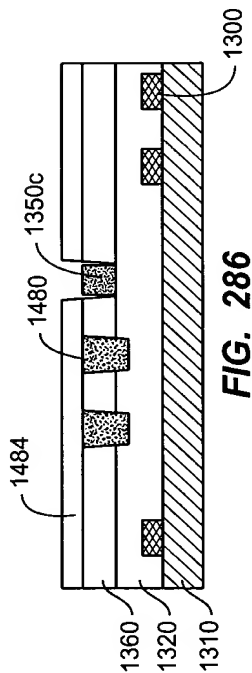
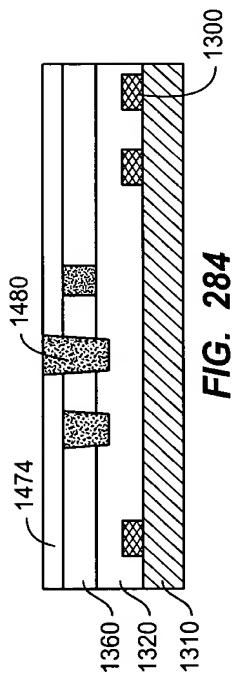
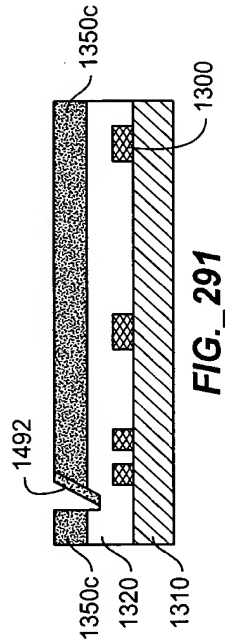
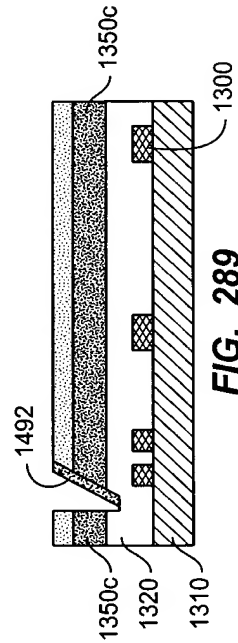
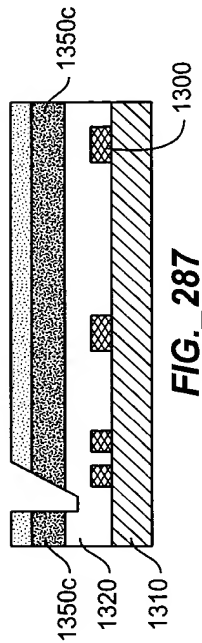
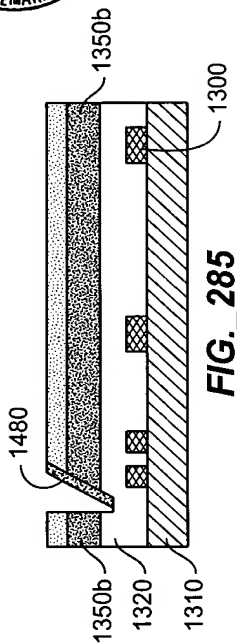












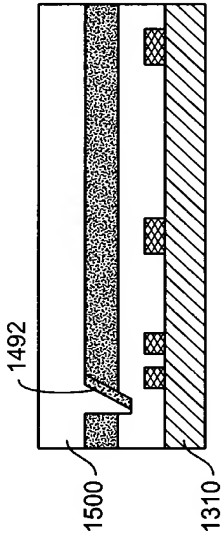


FIG. 293

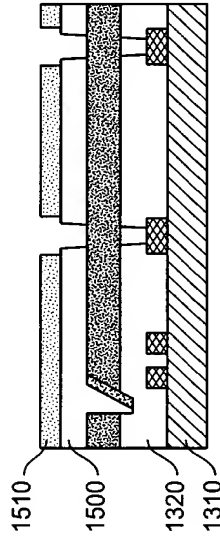


FIG. 295

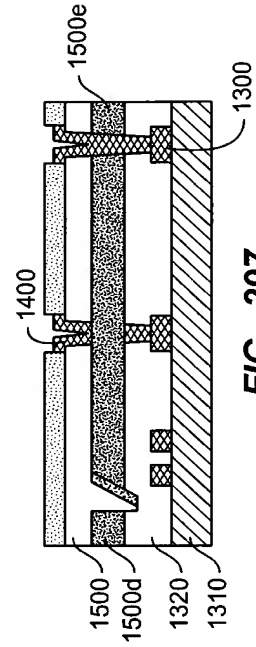


FIG. 297

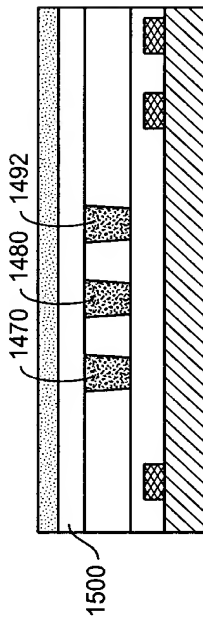


FIG. 292

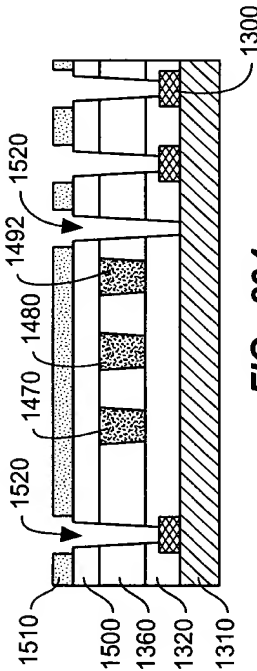


FIG. 294

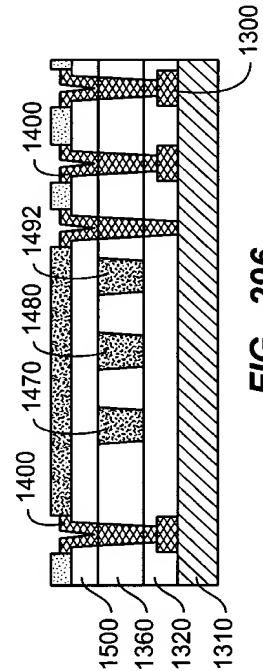


FIG. 296

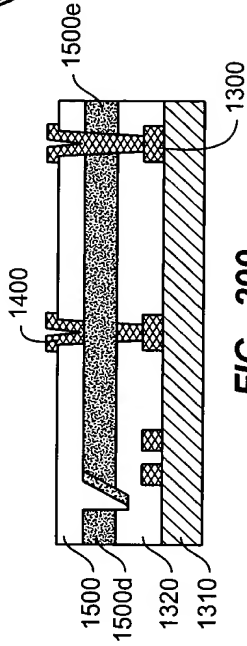


FIG. 299

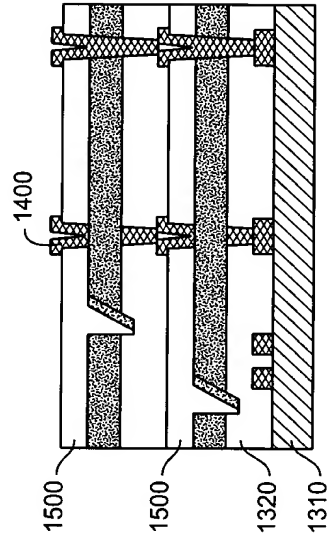


FIG. 301

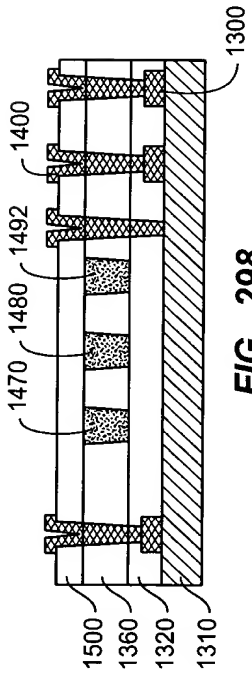


FIG. 298

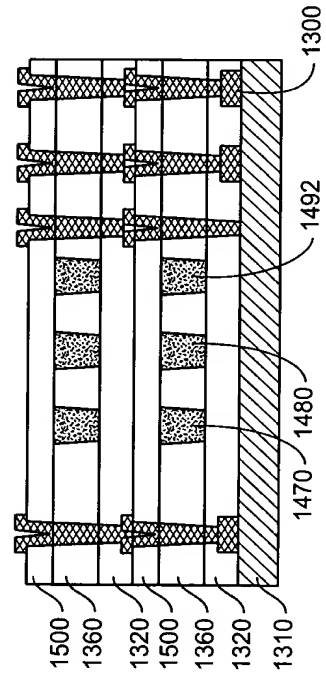


FIG. 300

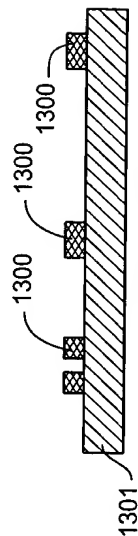


FIG. 303

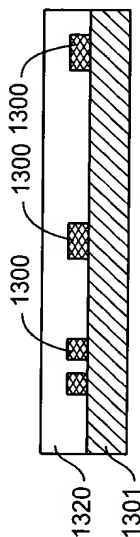


FIG. 305

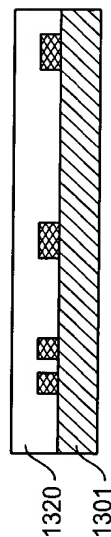


FIG. 307

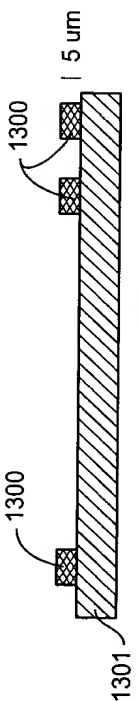


FIG. 302

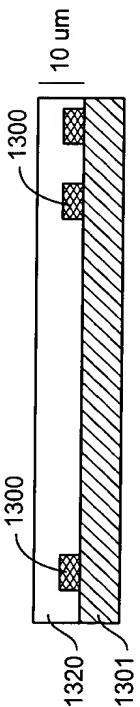


FIG. 304

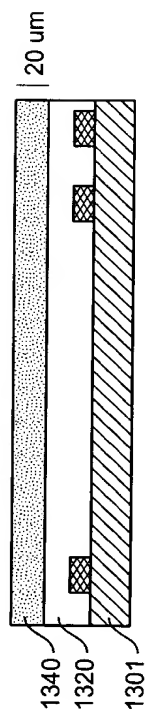


FIG. 306

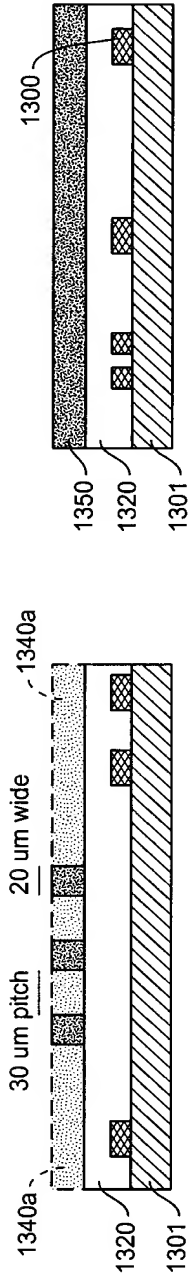


FIG. 308

FIG. 309

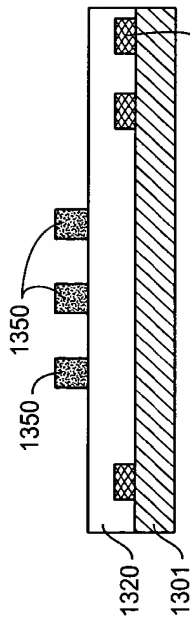


FIG. 310

FIG. 311

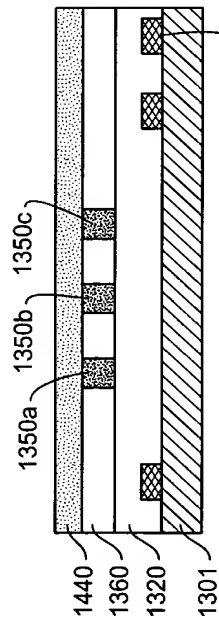
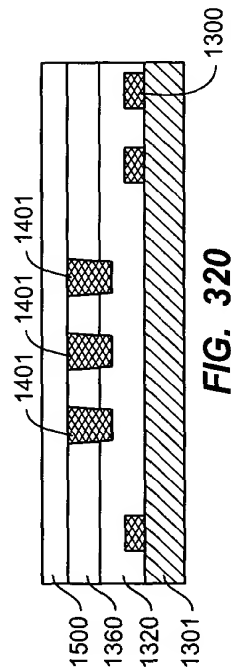
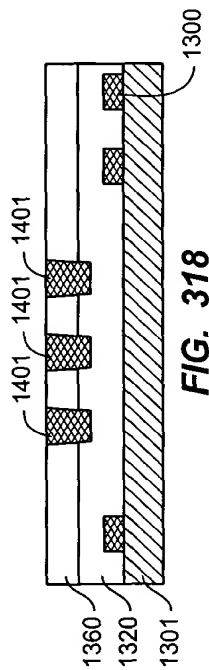
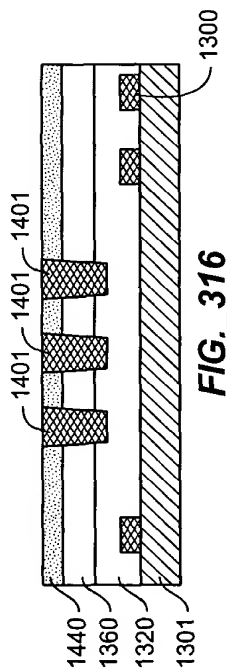
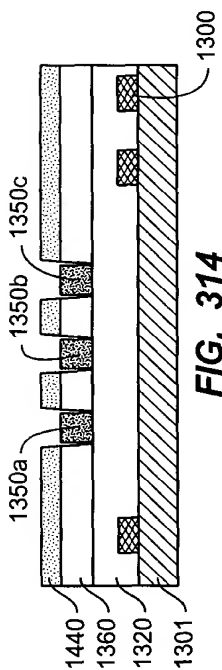
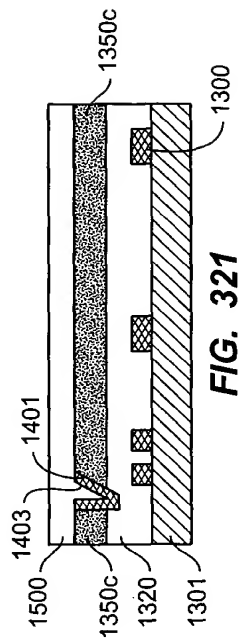
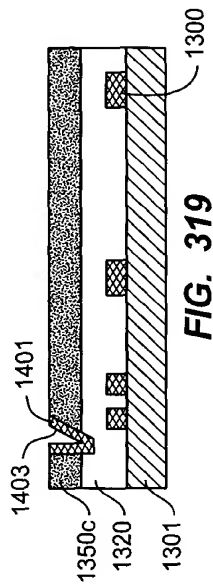
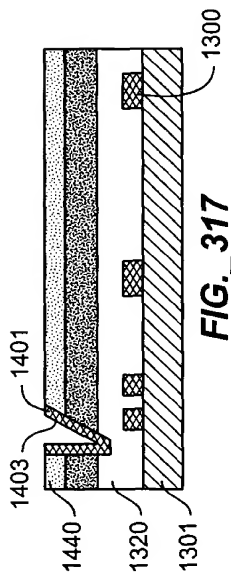
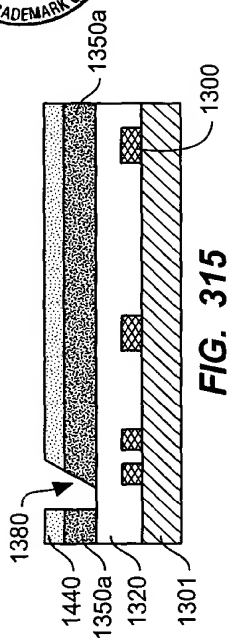


FIG. 312

FIG. 313



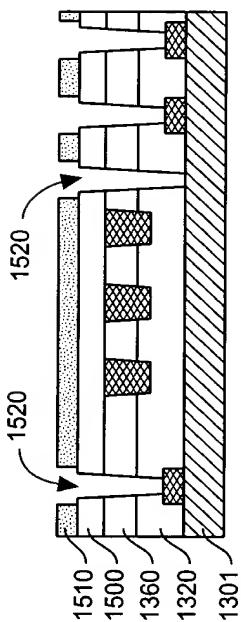


FIG. 322

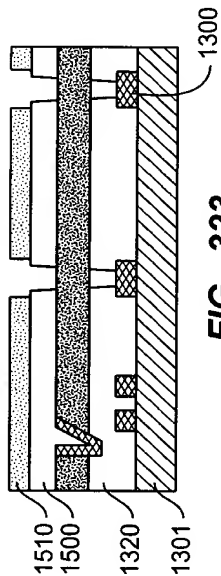


FIG. 323

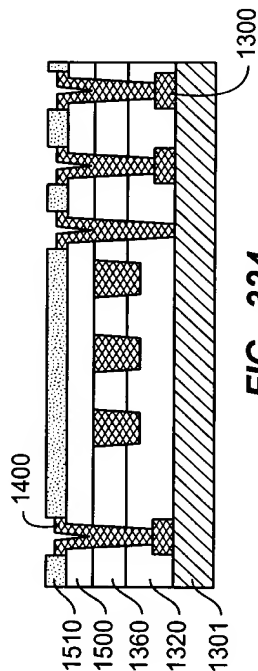


FIG. 324

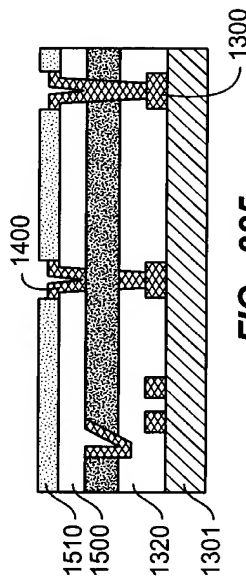
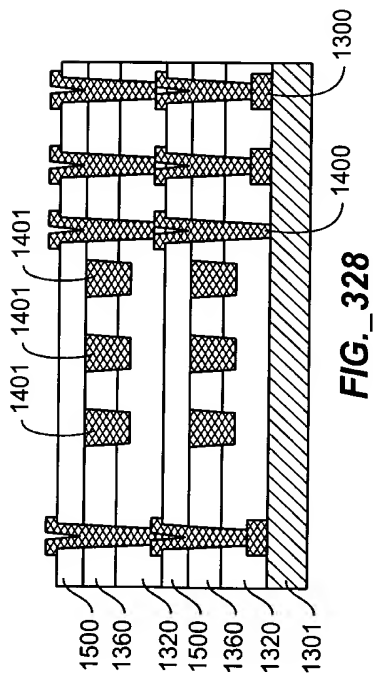
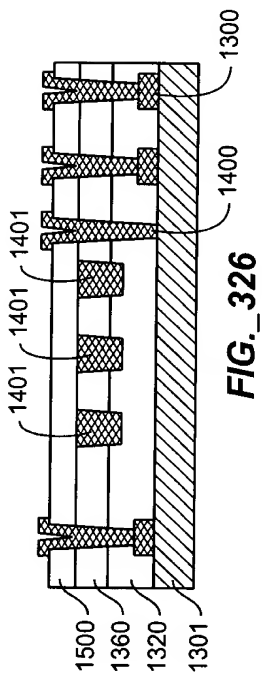
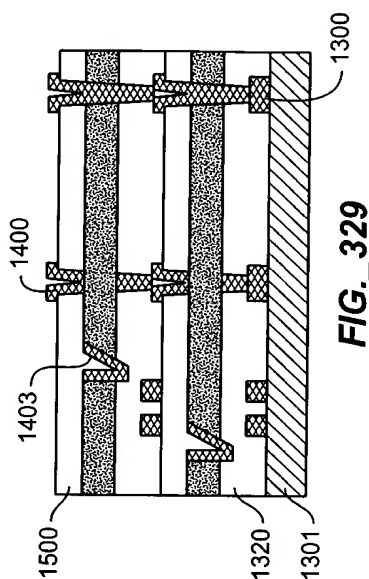
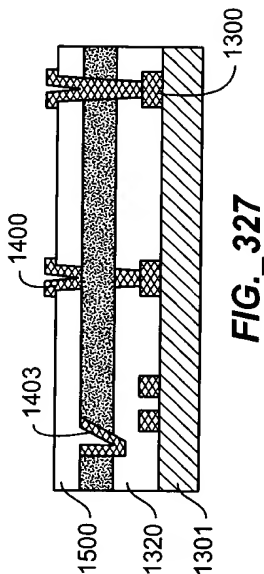
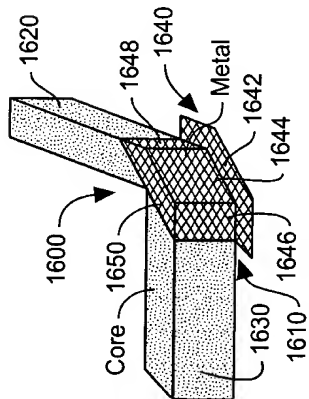
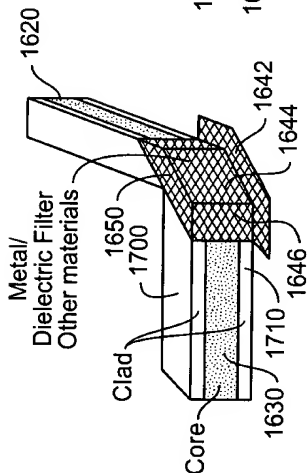


FIG. 325

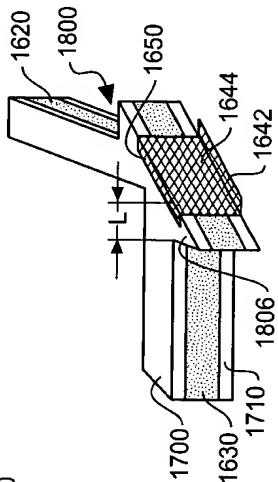




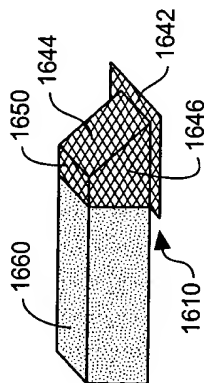
Conventional Corner Turning
FIG. 330



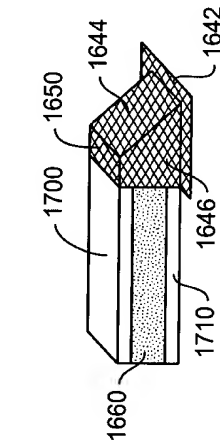
Invented Corner Turning (I)
FIG. 332



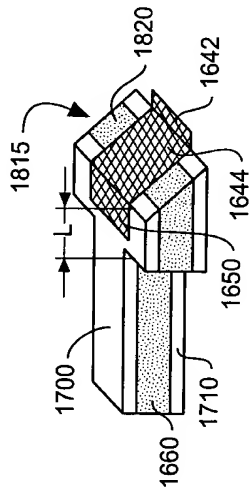
Invented Corner Turning (II)
FIG. 334



Conventional Coupler
FIG. 331



Invented Coupler (I)
FIG. 333



Invented Coupler (II)
FIG. 335



FIG. 336

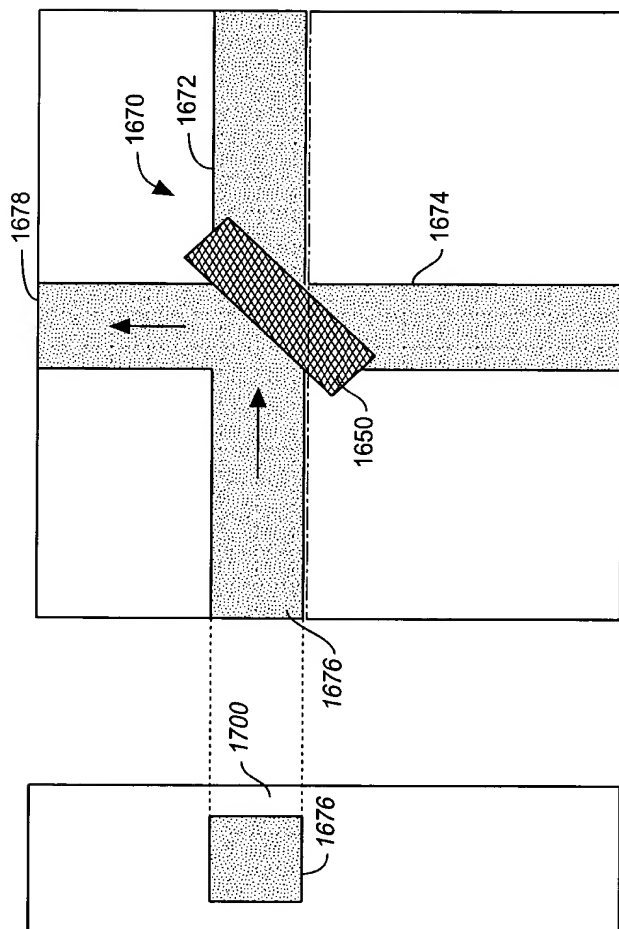
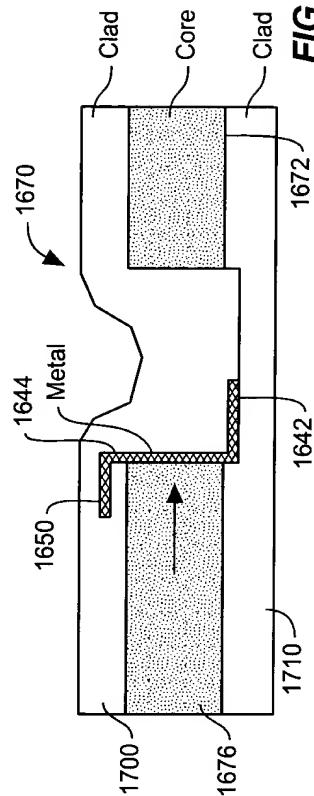


FIG. 337



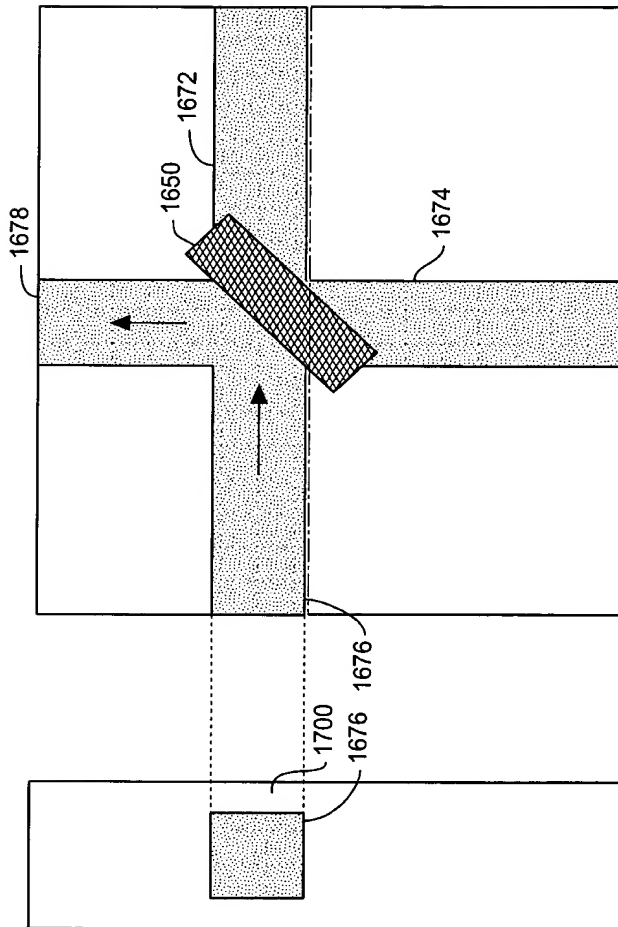
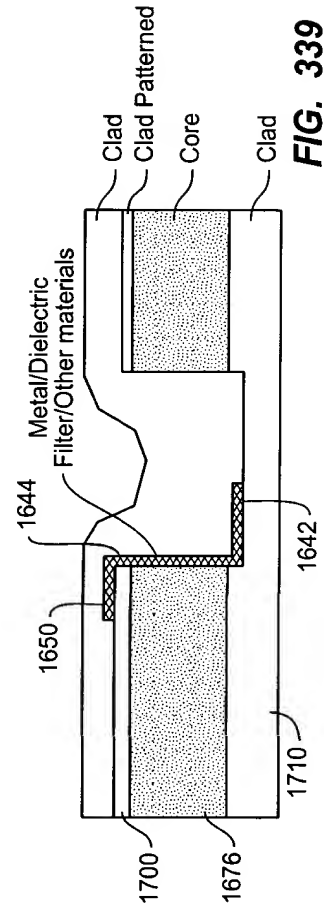
**FIG. 338****FIG. 339**



FIG. 340

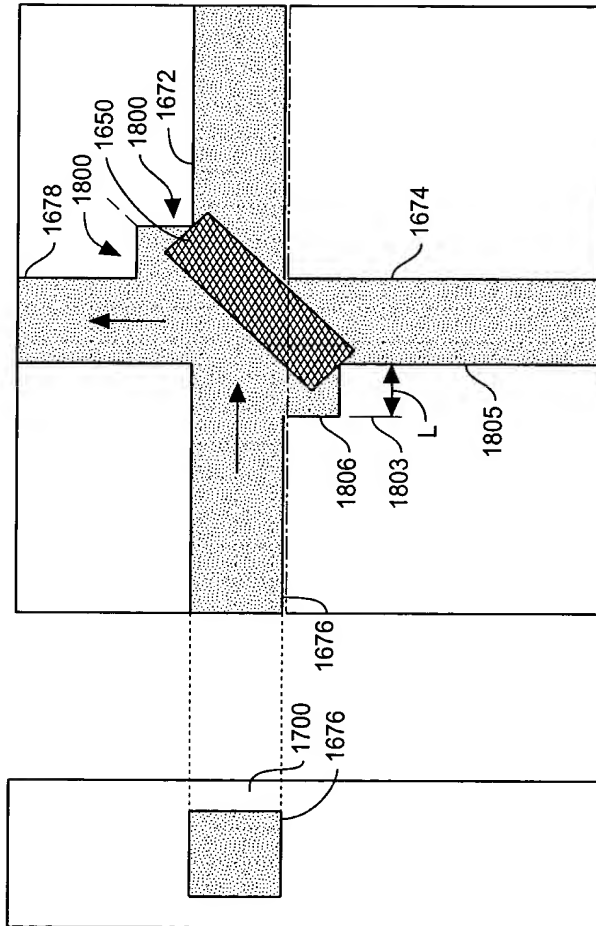
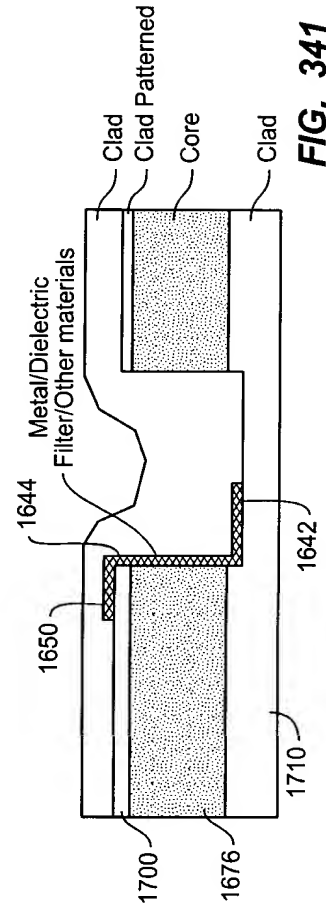
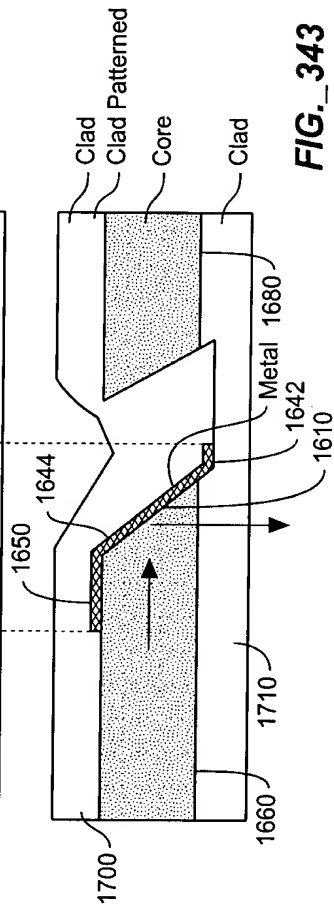
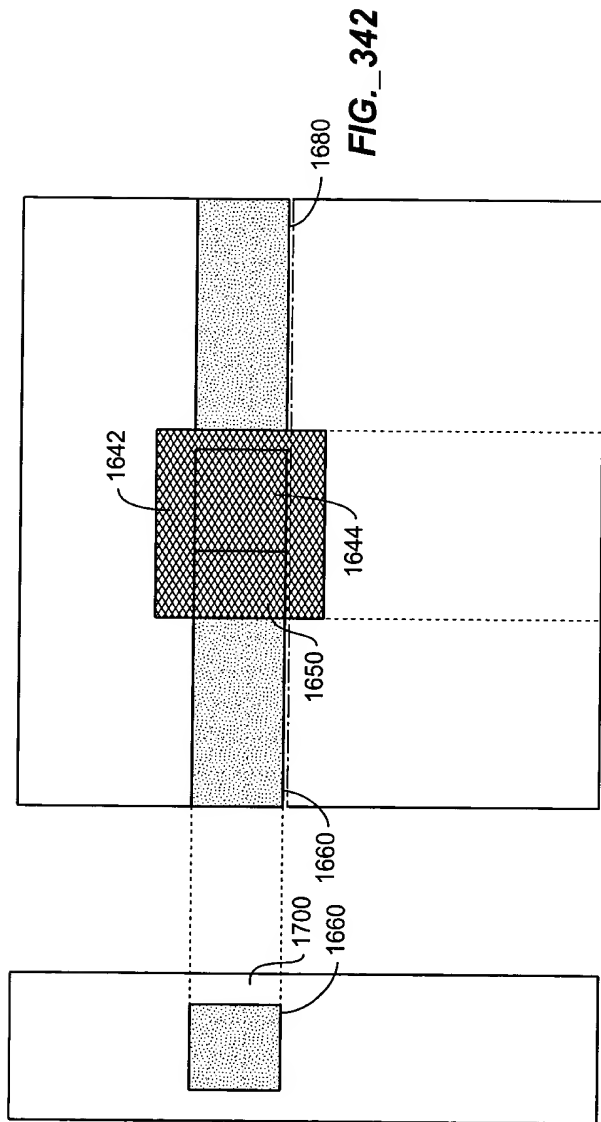
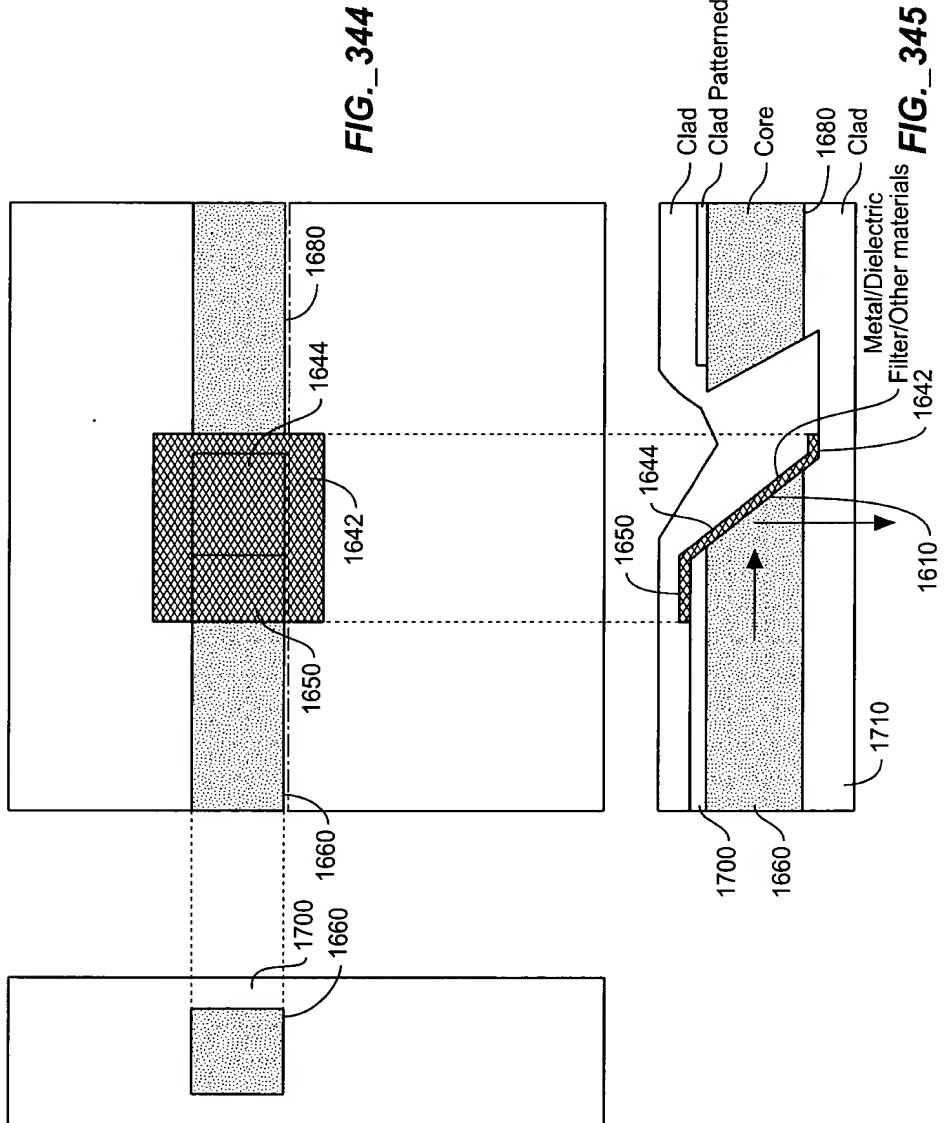
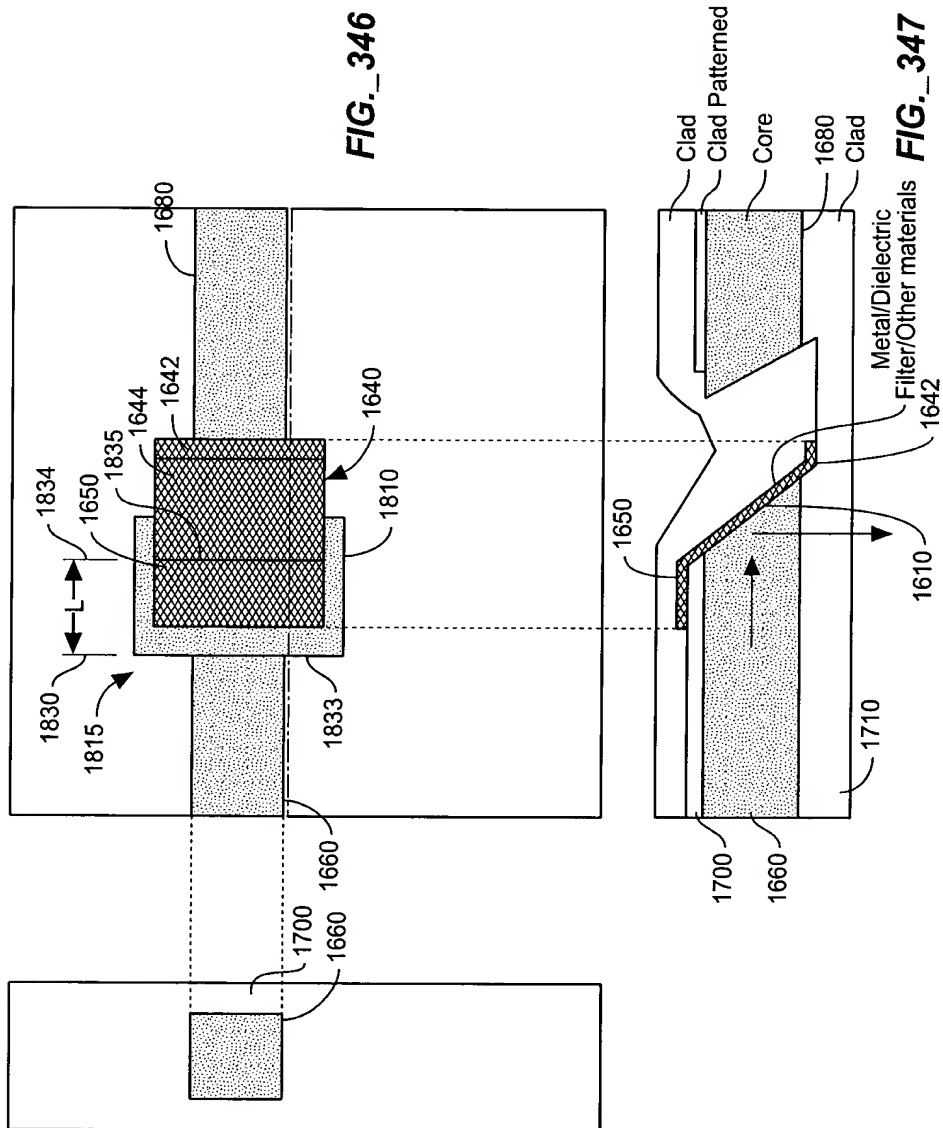


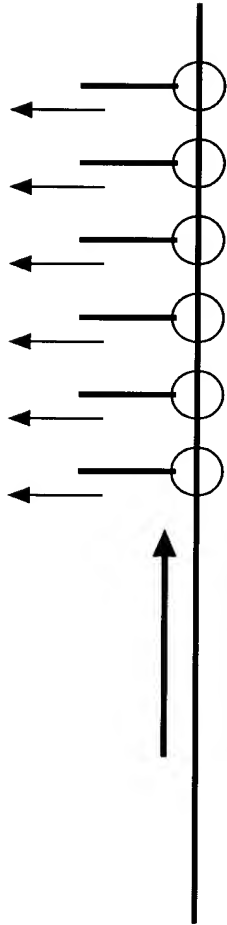
FIG. 341





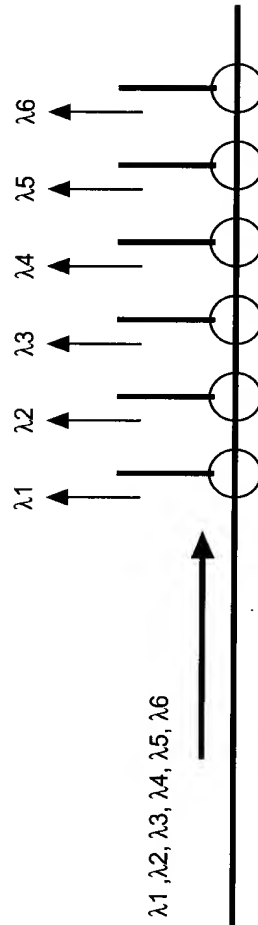






Beam Splitter

FIG. 348



WDM DEMUX

FIG. 349



Buffer/Clad/Core/Clad
 Mask formation
 For Waveguide/Coupler

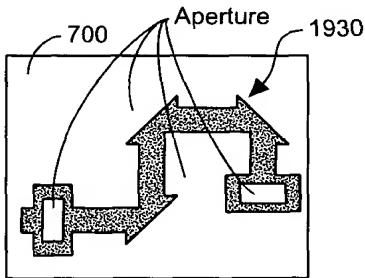


FIG. 350

Waveguide Formation
MNA or MNE

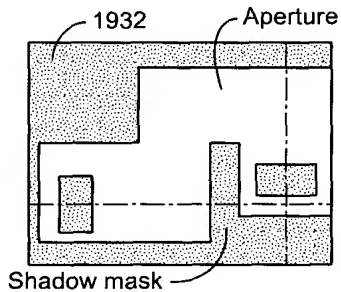


FIG. 355

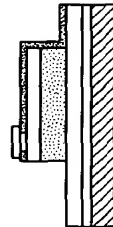


FIG. 357

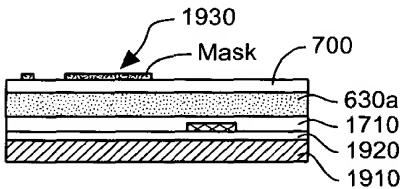


FIG. 351

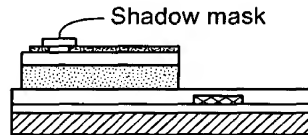


FIG. 356

(MNA: Moving Neon Ablation)
 (MNE: Moving Neon Etching)

Mask removal/
 Metal or
 Dielectric Filter or
 Other materials Deposition

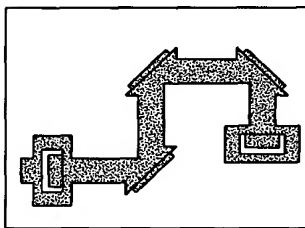


FIG. 352

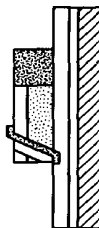


FIG. 354

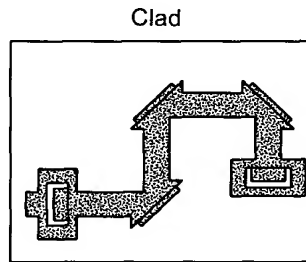


FIG. 358

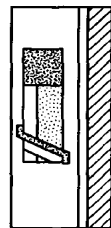


FIG. 360

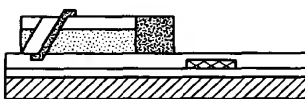


FIG. 353

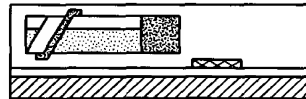


FIG. 359



Coupler Formation I
MNA or MNE

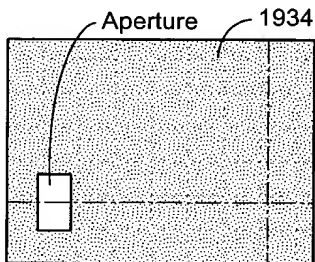


FIG._361

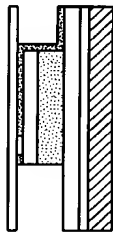


FIG._363

Coupler Formation II
MNA or MNE

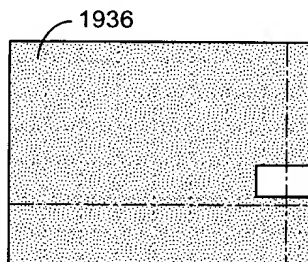


FIG._367

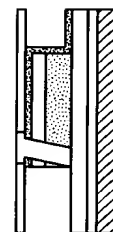


FIG._369

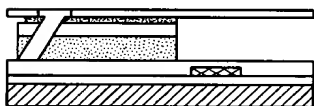


FIG._362

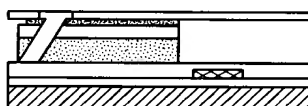


FIG._368

Materialization

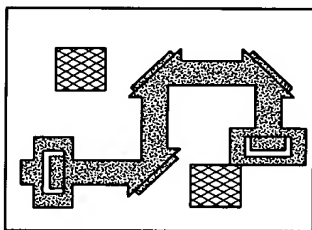


FIG._364

→ Top

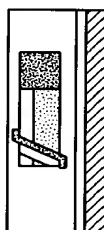


FIG._366

Z-Connection
Substrate
Removal

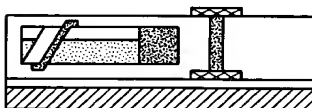


FIG._365

↓ Top

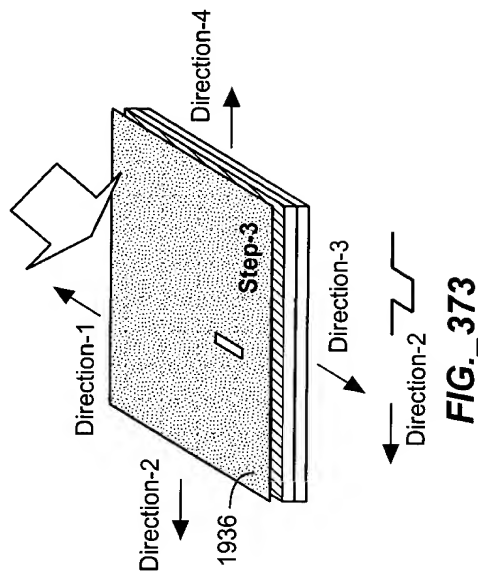
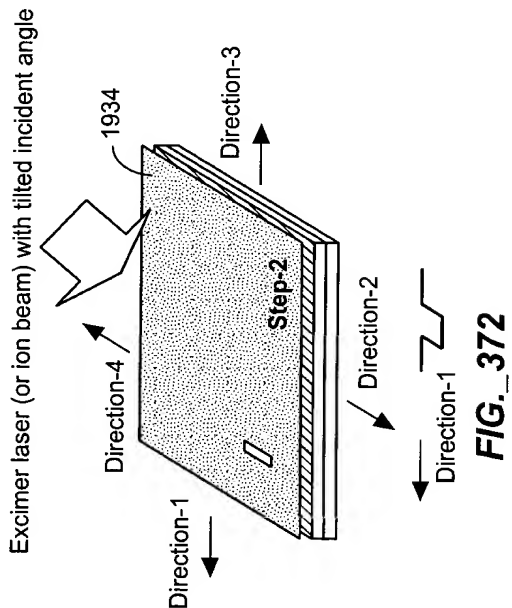
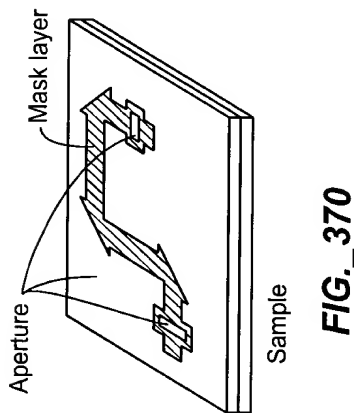
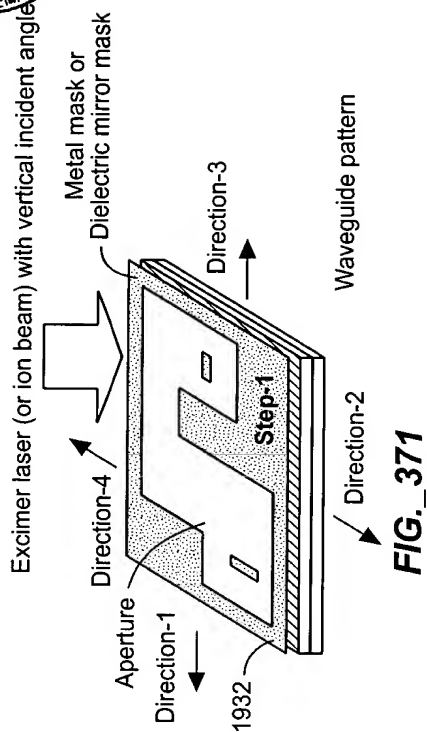




FIG. 374

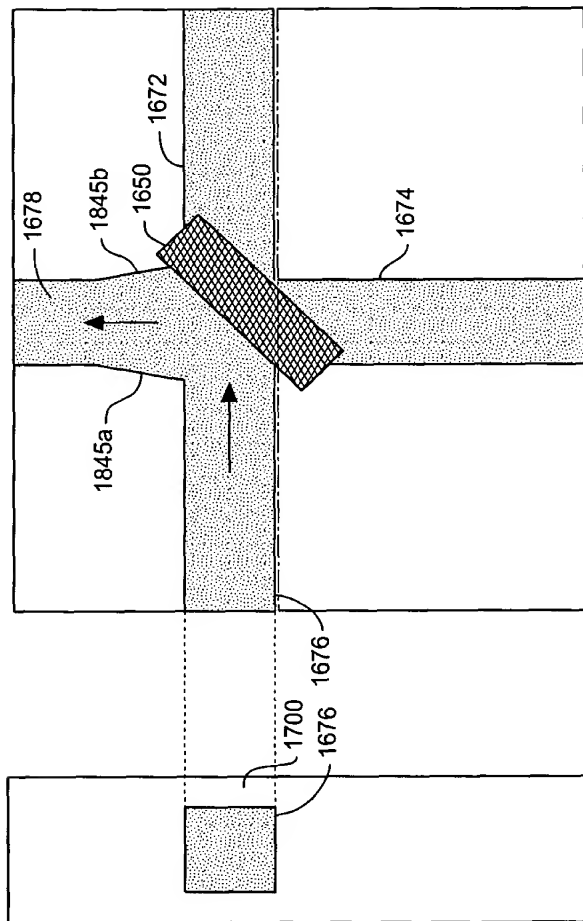
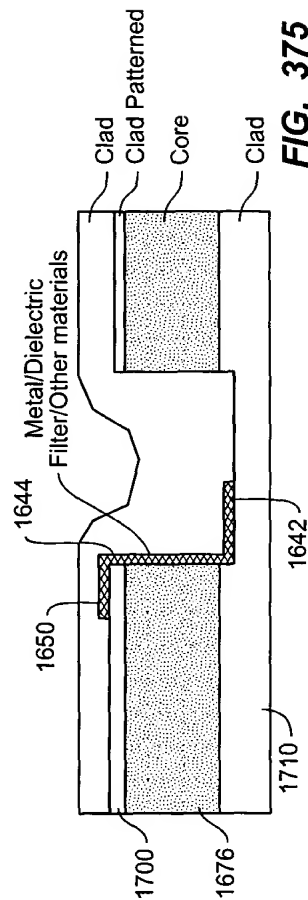


FIG. 375





Example 3: Z waveguide Fab. Process 1

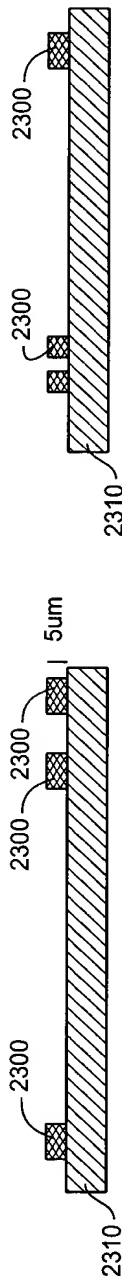


FIG. 376

FIG. 377

(a1) Metal pattern formation

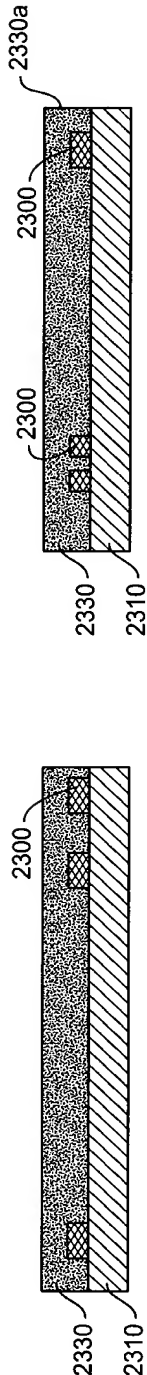


FIG. 378

FIG. 379

(a2) Core coat
[DuPont, AlliedSig, ORMOCERs or F-PI]

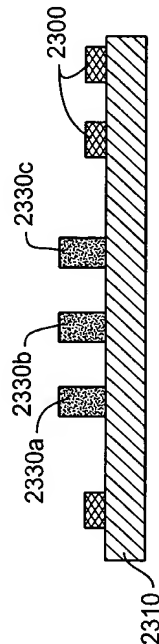


FIG. 380

FIG. 381

(a3) Z-WG core patterning
[UV-Exposure, mask-formation+RIE,
Laser, or Dupont process]

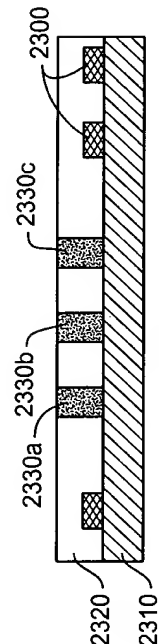


FIG. 382

FIG. 383

(a4) Clad coat
(for planarization viscosity adjust
if necessary CMP)

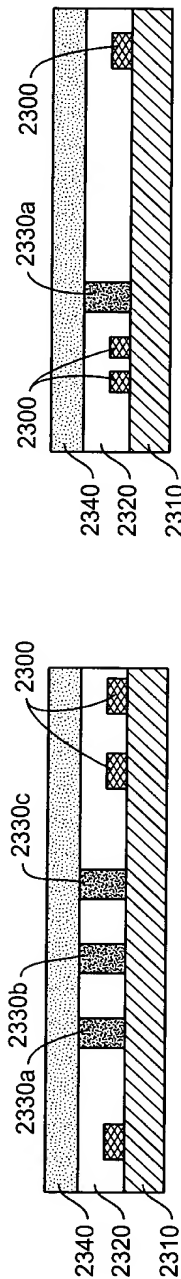


FIG. 384

FIG. 385

(a5) Core coat
[DuPont, Allied Signal, ORMOCERs or F-PI]

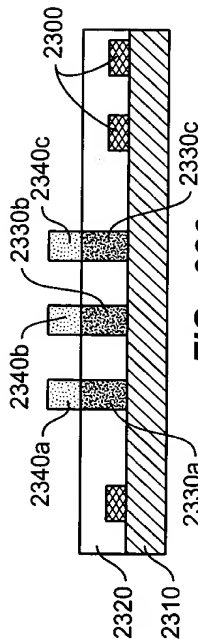


FIG. 386

FIG. 387

(a6) WG core patterning
[UV-Exposure, mask-formation+RIE,
Laser, or DuPont process]
Development
(for Allied Signal, ORMOCERs)

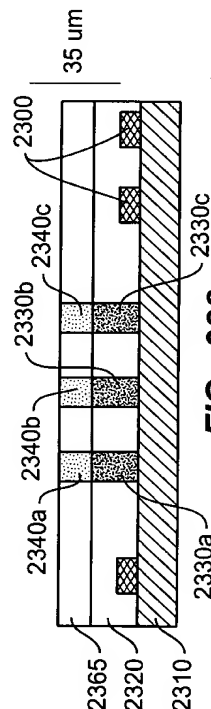


FIG. 388

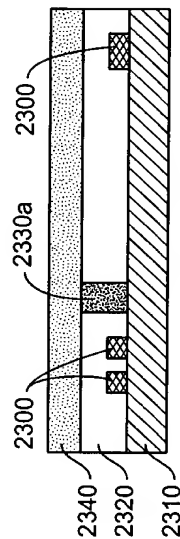
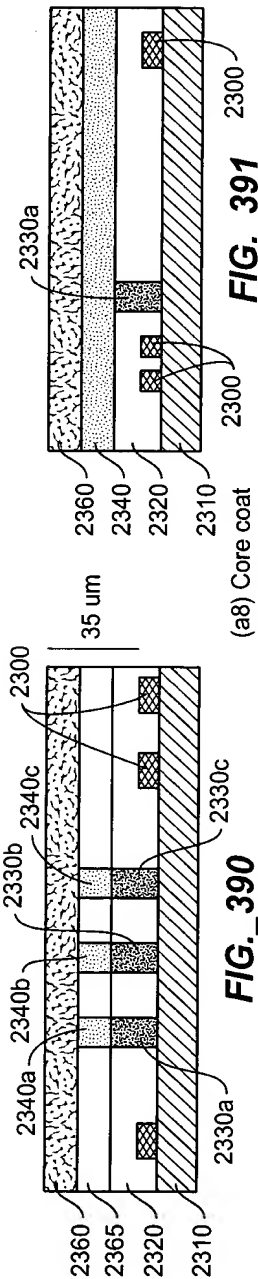
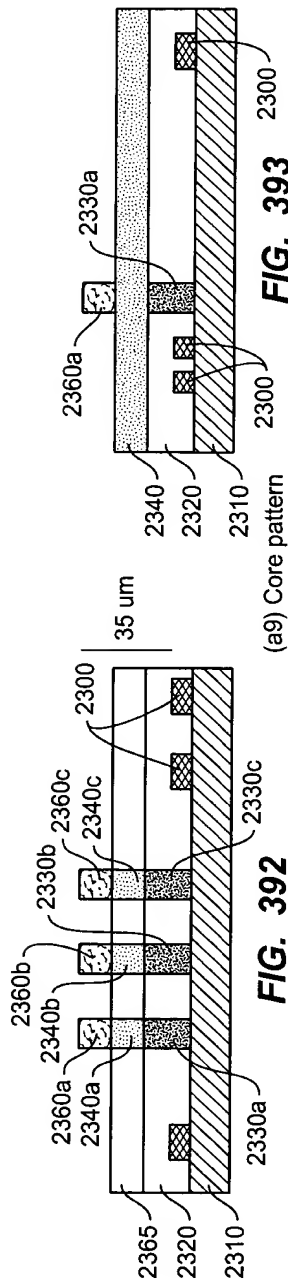


FIG. 389

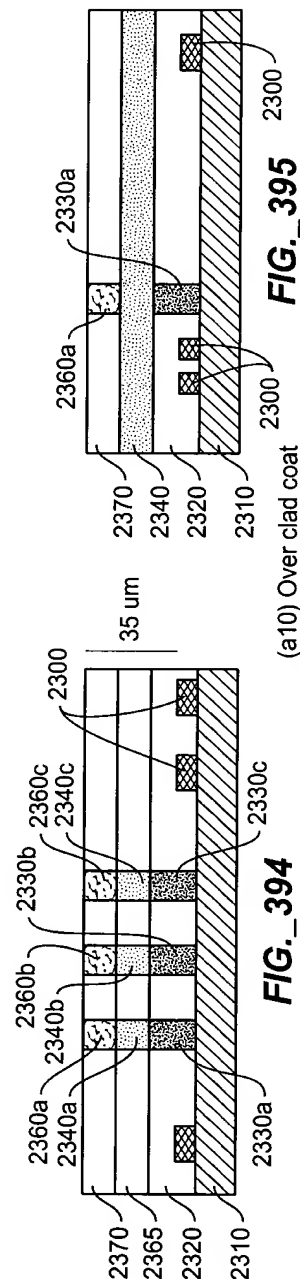
(a7) Over clad coat
[DuPont, Allied Signal, or F-PI]
(for planarization viscosity adjust
if necessary CMP)

**FIG. 391**

(a8) Core coat

**FIG. 393**

(a9) Core pattern

**FIG. 395**(a10) Over clad coat
(for planarization viscosity adjust
if necessary CMP)



Example 4: Z waveguide Fab. Process 2

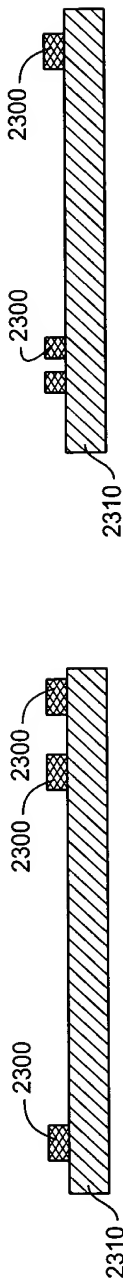


FIG. 396

(a1) Metal pattern formation

FIG. 397

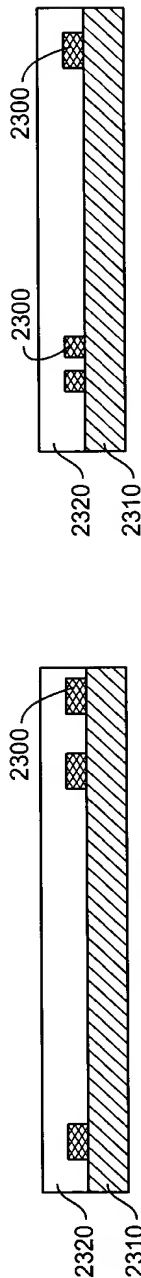


FIG. 398

(a2) Clad coat

[DuPont, Allied Signal, ORMOCERs or F-PI]

FIG. 399

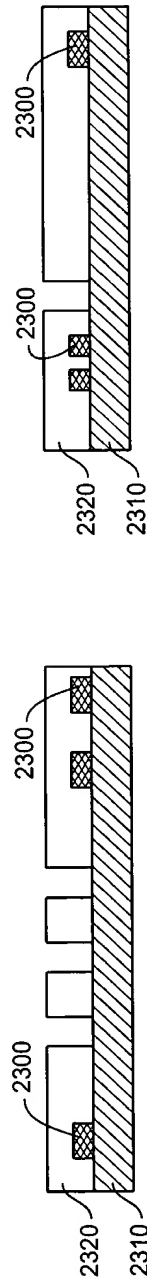


FIG. 400

(a3) Clad patterning

[UV-Exposure, mask-formation+RIE,
Laser, or Dupont process]
Development (for Allied Signal, ORMOCERs)

FIG. 401

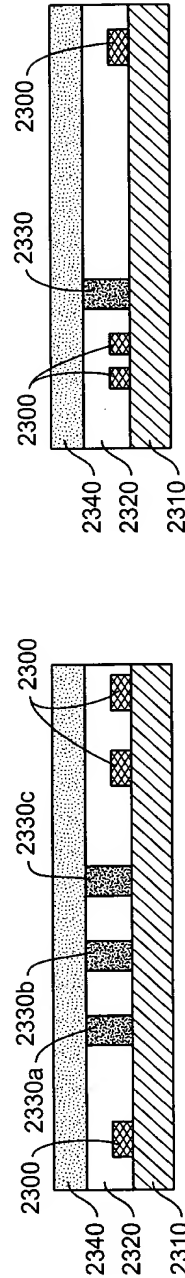


FIG. 402

(a4) Core coat

(for planarization viscosity adjust if necessary CMP)

FIG. 403

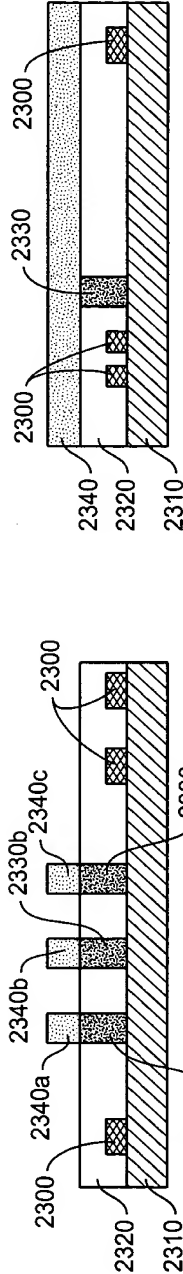


FIG. 404

FIG. 405

(a5) WG core patterning
[UV-Exposure, mask-formation+RIE,
Laser, or Dupont process]
Development (for Allied Signal, ORMOCERS)

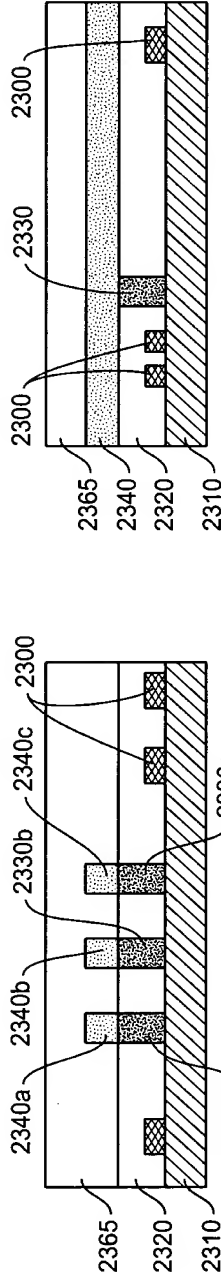


FIG. 406

FIG. 407

(a6) Over clad coat
[DuPont, Allied Signal, or F-PI]
(for planarization viscosity adjust if necessary CMP)

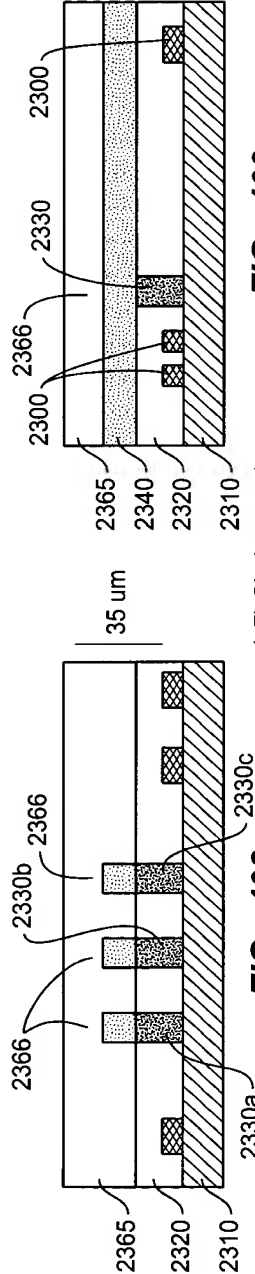
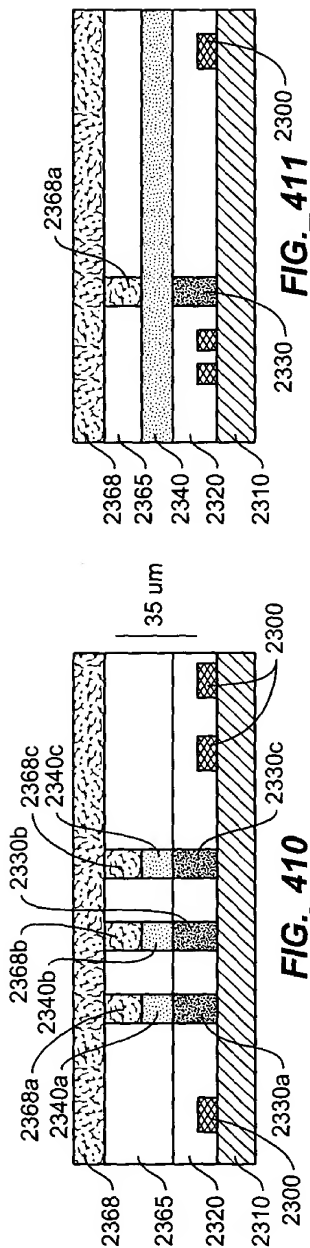


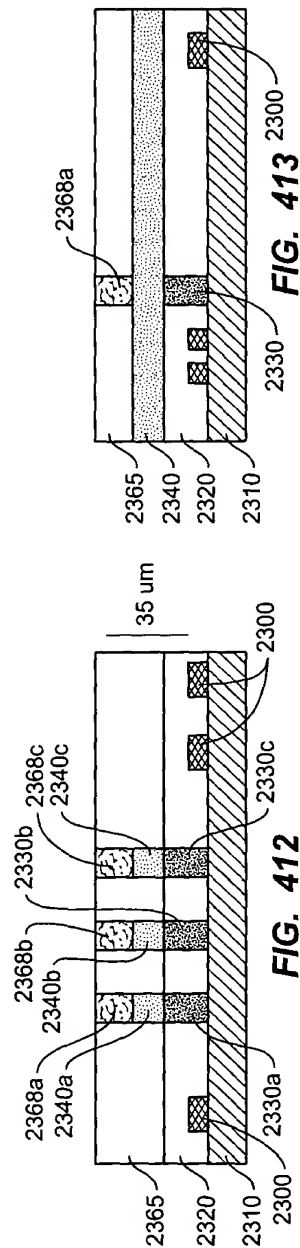
FIG. 408

FIG. 409

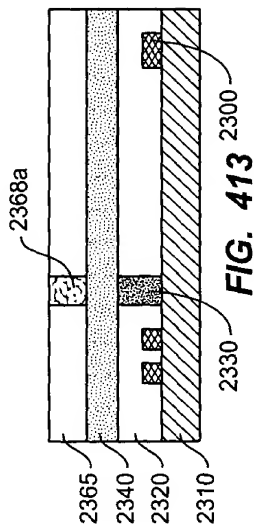
(a7) Clad patterning
[UV-Exposure, mask-formation+RIE,
Laser, or Dupont process]
Development (for Allied Signal, ORMOCERS)



(a8) Core coat
(for planarization viscosity adjust
if necessary CMP)



or
(a8) Core coat and CPM



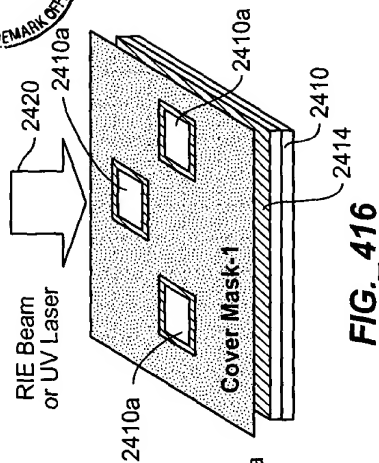


FIG. 416

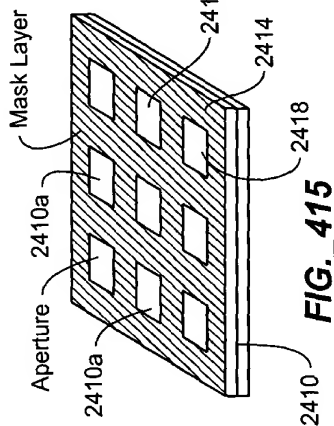


FIG. 415

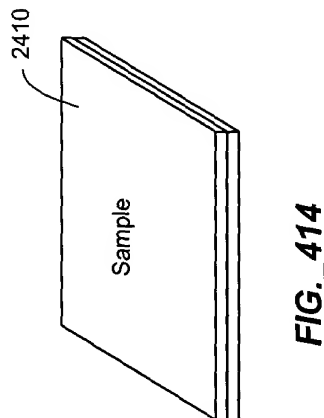


FIG. 414

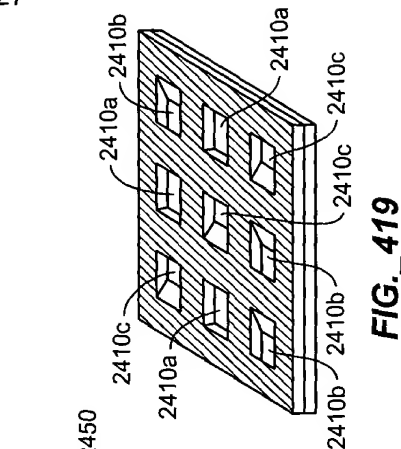


FIG. 419

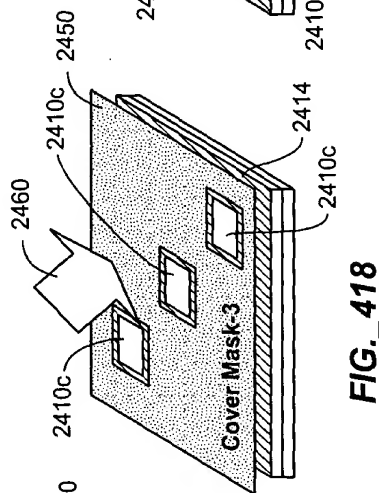


FIG. 418

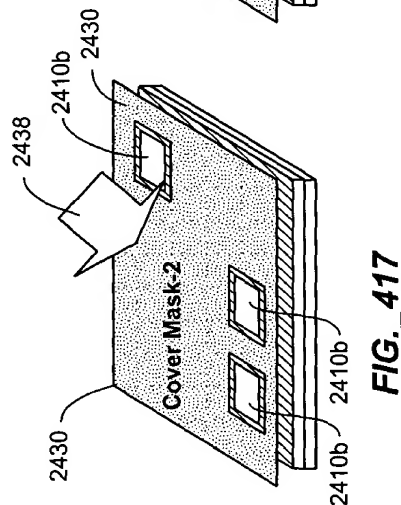
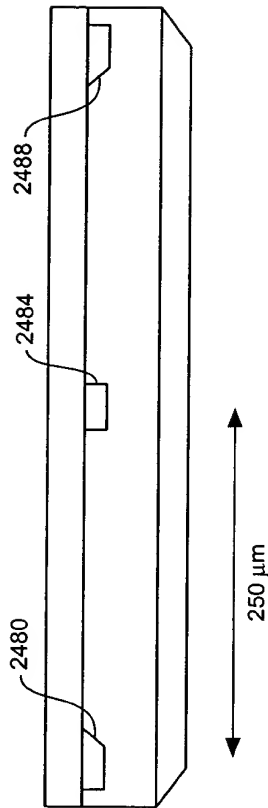


FIG. 417



(b) Trench wall formation of three different angles

FIG. 420